VOL. XVII. No. 11 NOVEMBER 1932

MECCANO MAGAZINE

MOBILE CRANE AT WORK
(see page 828)

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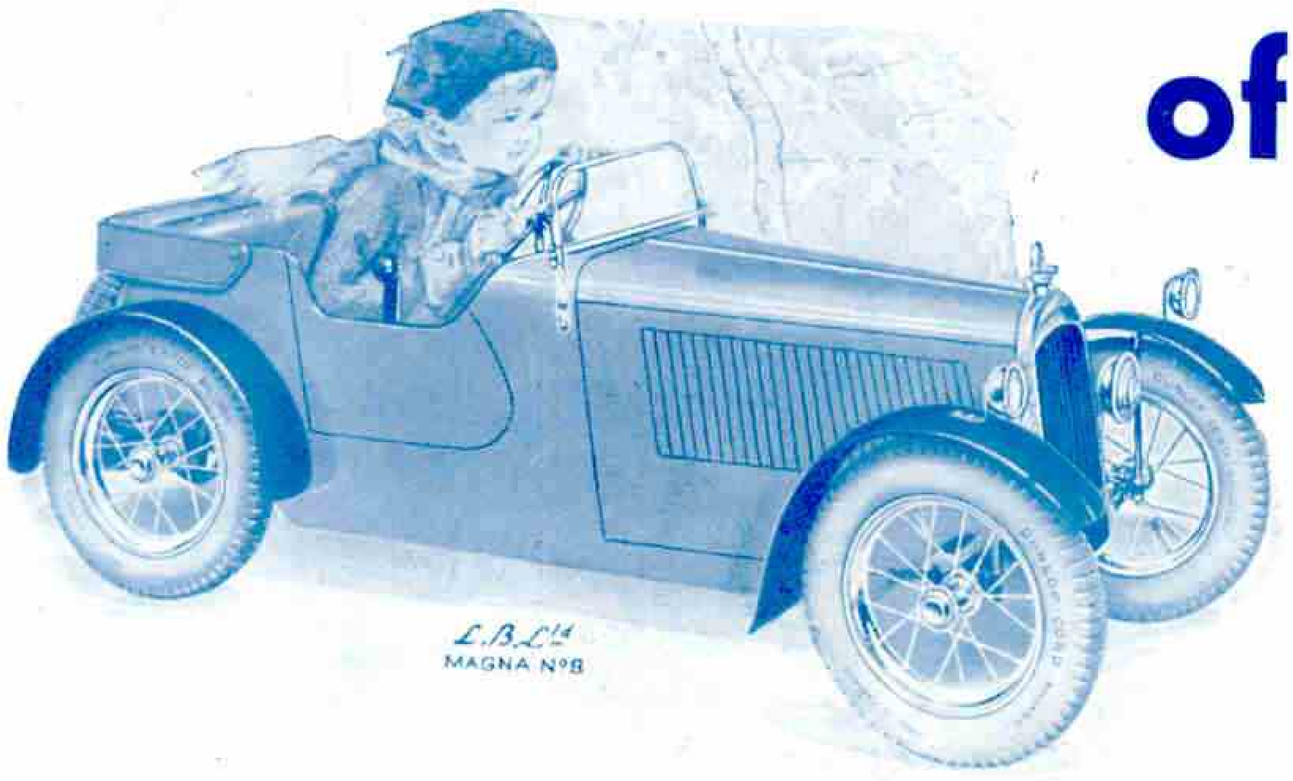

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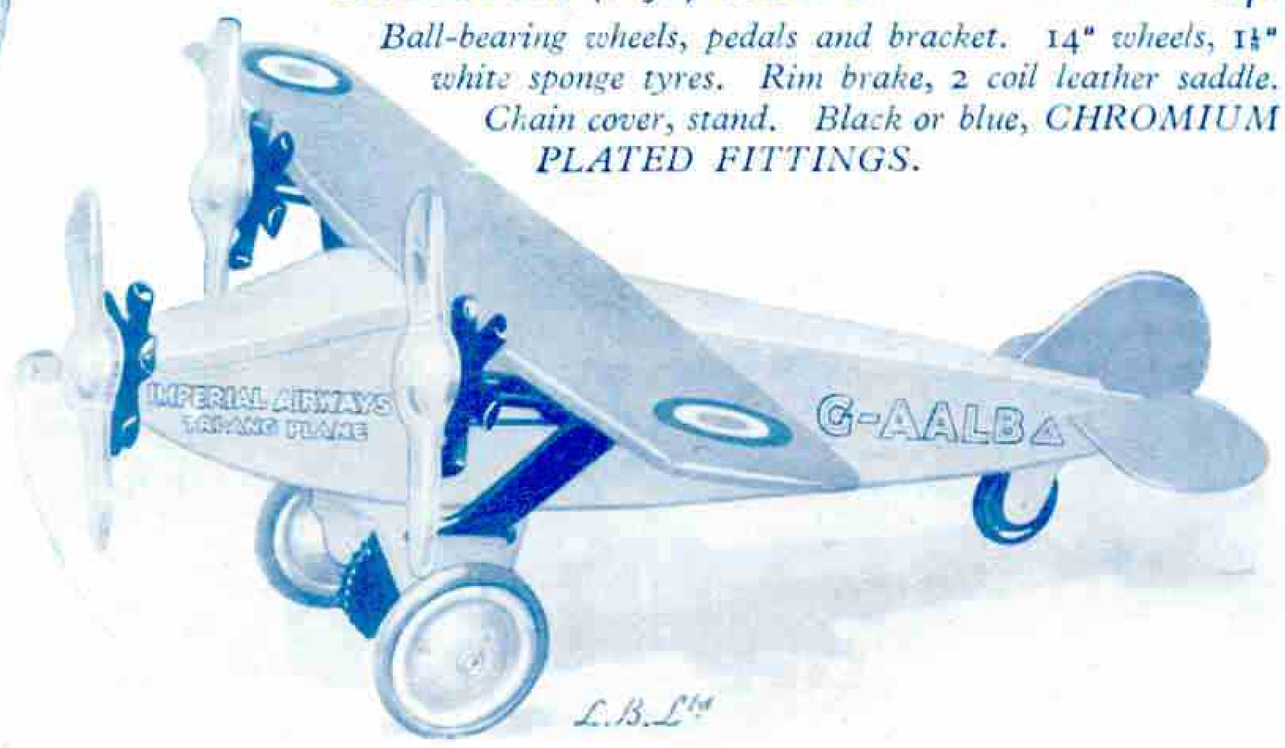

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MECCANO MAGAZINE

Editorial Office:
Binns Road
Liverpool
England

Vol. XVII. No. 11
November, 1932

With the Editor

Sir Ronald Ross

The death of Sir Ronald Ross comes as a reminder that a great scientist and discoverer may devote his lifetime to work that results in the saving of millions of lives, yet remain almost unknown to the general public, and end his career in straitened circumstances. Ross worked quietly and patiently in his laboratory, striving to solve the mystery of a disease that has ravaged tropical countries for centuries. Work of this kind results in ultimate fame, but it seldom brings an immediate reward to its author.

The disease of which Ross sought the cause was malaria. For a long time it had been thought that this disease was peculiar to swampy countries, and the avoidance of marshes and the drainage of low-lying areas had done something towards checking it. In many parts of India and other tropical lands it was prevalent where there were no marshes, however, and no really effective means of combating it were known. Ross began his work in 1892, and his great opportunity came in 1895, when he was a major in the Indian Medical Service. It had already been discovered that a parasite in the blood stream of malarial patients was concerned in the transmission of the disease, and Ross believed that one stage in the life history of this parasite was spent in the mosquito. He determined to put his theory to the test, and for years every moment that he could snatch from his official duties was spent in examining mosquitoes under the microscope. He met with continual disappointment but never gave up hope, and success came at last when his instrument revealed the parasite in a species of mosquito of which he had previously examined only a few specimens.

The late Sir Ronald Ross, K.C.M.G., K.C.B., F.R.S.

This discovery was the key to the solution of the problem of banishing malaria. Even yet Ross's work was not at an end, however, for he was faced with the difficult task of convincing the world of the truth of his discovery. He threw himself into this fight with the same energy and patience that he had displayed in his laboratory, and ultimately it was proved conclusively that malaria could only be controlled by supplementing treatment of the disease itself by quinine and other drugs with relentless warfare against the insects responsible for its transmission.

Malaria and the Panama Canal

When the truth of Ross's work had been thoroughly established, vigorous measures were taken to make the malaria-infested countries of the tropics fit for human habitation, and the completion of the Panama Canal is a remarkable proof of the effectiveness of these measures. When De Lesseps, the famous French engineer who built the Suez Canal, made his unsuccessful effort to pierce the isthmus at Panama, one main cause of his failure was the enormous number of deaths from malaria that occurred among his workmen. By the time the American Government had undertaken the completion of the task Ross had made his great discovery, and the first step taken was to clean up the Canal Zone by a vigorous assault on the mosquito. The result was that this stretch of country was freed from the disease, and work henceforth was carried on in healthy conditions.

The value of the work of Sir Ronald Ross is to be measured not only by the enormous number of lives saved, but also by the great area of productive land in many tropical and sub-tropical regions that has become available for development, now that the dreaded mosquito has been banished, or had its activities restricted.

The author of this transformation received the greatest honours that can be paid to a scientist, among them the award of the Nobel Prize for Medicine in 1902. Unfortunately he received no reward from the Governments of the countries that had derived so much benefit from his work, however, and it is sad to learn that in 1929, when he was 72 years of age, he was in such straitened circumstances that he was compelled to sell the records of his researches in order to provide in some measure for the needs of his old age. In the end it was left to private subscription to raise a fund to relieve him of his anxiety in his closing years.

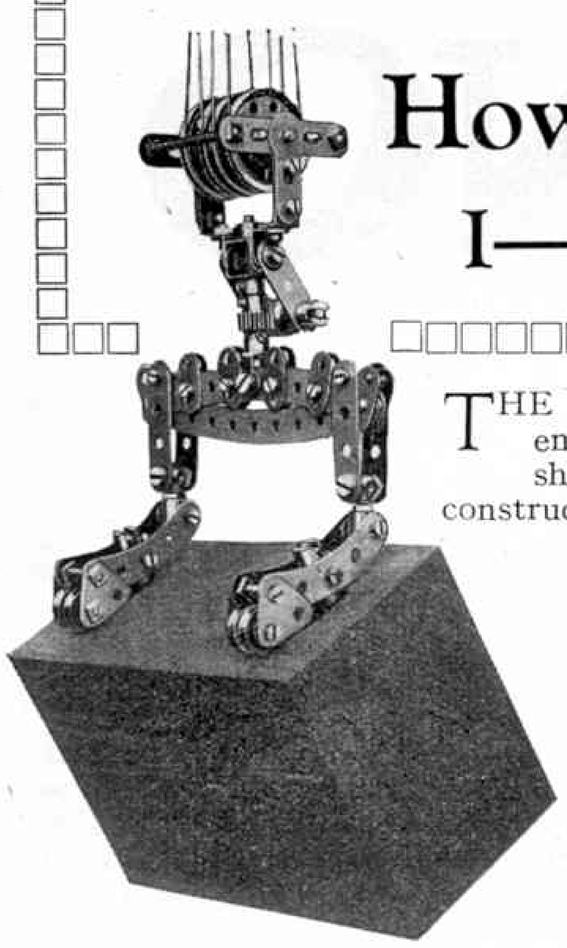
Conquering Mount Everest

Ever since the dread and horror with which mountains were once regarded was overcome, climbers have looked to all parts of the world in order to find new peaks to conquer. One by one the giants of the great ranges are being climbed, and to-day the only important heights that have not been conquered are in the Himalayas. Wonderful climbing feats have been performed in this mighty range, and the story of the attack in 1924 on the snow-clad slopes of Mount Everest, when a height of 28,100 ft. was attained, can scarcely be matched as a record of courage and determination. A new effort is to be made to climb this mountain, and as those taking part in this will have the experience of previous expeditions behind them, it seems likely that at last Everest will be conquered. Mallory and Irvine, who lost their lives in the earlier attempt, may actually have reached the summit, for when last seen they were within 800 ft. of it. The mystery of their fate may be solved when the mountain is again attacked.

Some readers may wonder whether efforts to ascend Mount Everest are really worth while. The answer to this is that the struggle with a mountain is evidence of man's determination to make himself supreme on earth. Sir Francis Younghusband, a pioneer of exploration in the Himalayas, says of Mount Everest that "the mountain may be high. But man will show that his spirit is higher. And he will not be content until he has it in subjection under his feet." It is of course easy to reach even greater heights than any in the Himalayas by means of aeroplanes and balloons, but the use of machines does not bring with it the complete satisfaction derived from success due to man's unaided efforts and determination.

How the Engineer holds back the Sea

I—Giant Block-Setting Cranes at Work



Meccano model of Fidler's Gear, which reproduces all the movements of the original.

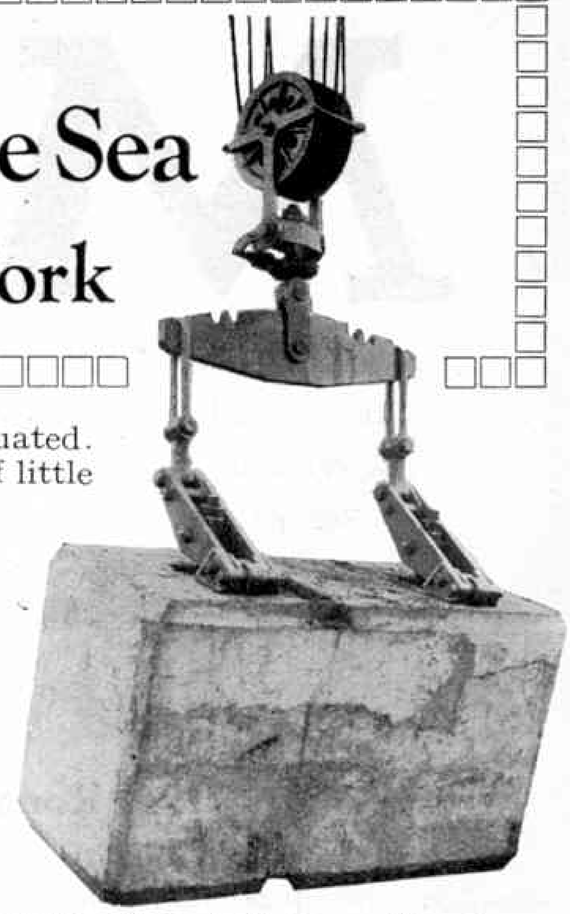
THE mastery of the Earth that the engineer is acquiring is nowhere shown more emphatically than in the construction of sea-walls and of great harbours in which ships may find shelter from storms and land their cargoes without disturbance. Other engineering achievements such as bridges, tunnels and canals are no doubt impressive, but when the initial difficulties of their construction have been overcome, their maintenance is a comparatively easy matter, whereas sea-walls are subject to continuous hammering from the waves and depend for their continued usefulness on constant observation and repair.

On this account harbour engineering possesses a fascination of its own and the reasons that make sea-walls necessary, and the remarkable methods of under-water construction adopted in building them, are of the greatest interest. The great expansion in shipping, due to the introduction of steam power last century, is mainly responsible for the present-day importance of this branch of engineering, but harbour works became a necessity much earlier in maritime countries such as Great Britain, in spite of the existence of natural harbours. It is on the methods adopted to protect the frail wooden vessels of Tudor times from the fury of the waves that the engineers of to-day have founded their plans.

It is a curious fact that almost every country with a sea coast seems to have at least one natural harbour, and in many cases these are sufficiently large to accommodate large fleets of ships. One of the largest of these natural harbours is the Bay of Rio de Janeiro in South America, which runs in a northerly direction for 15 miles with a width varying from two to seven miles. Surrounded by high mountains, with an entrance less than a mile in width, it is protected on each side by bold headlands.

In Great Britain, Milford Haven in Wales, stretching inland for some 10 miles, is unequalled as a sheltered harbour. Other natural harbours are formed by the mouths of rivers, such as the Thames, Mersey, Humber, Forth, and the Seine, but their efficiency is somewhat diminished by the 'bar' that forms where the outflowing current of the river is checked by the sea.

Although such natural harbours as these continue to be useful they are not all favourably situated. Milford Haven, for instance, is of little importance from a naval point of view, and is too far away from centres of trade and manufacture for use as a commercial harbour. The requirements of modern times have therefore made it necessary to augment the number of harbours, either by improving some natural feature—such as a bay or an inlet—or by constructing more elaborate works and enclosing large areas of the sea by harbour walls or breakwaters.



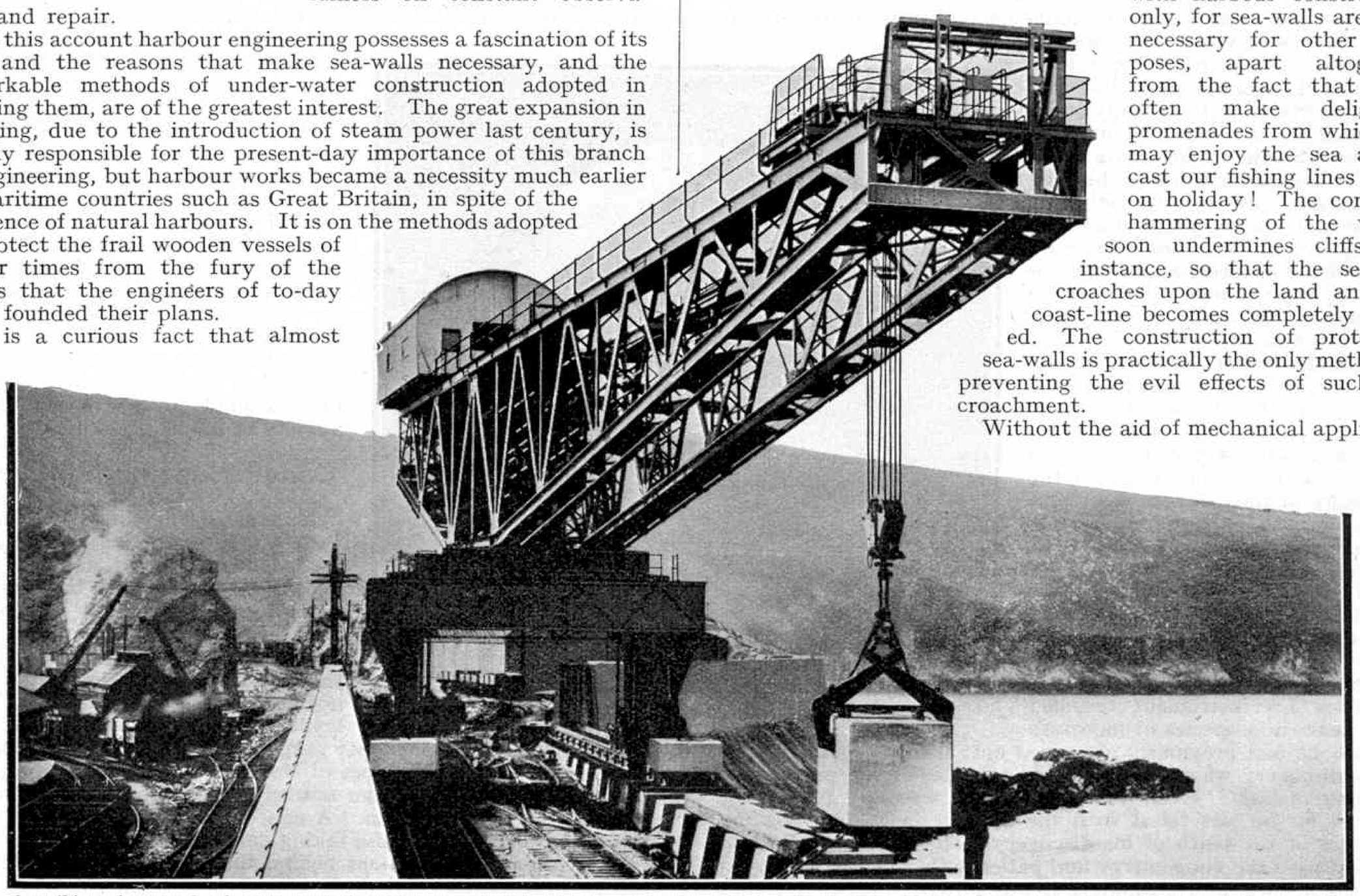
Concrete block held in position by Fidler's Gear.

The branch of engineering under consideration is not concerned with harbour construction only, for sea-walls are very necessary for other purposes, apart altogether from the fact that they often make delightful promenades from which we may enjoy the sea air or cast our fishing lines when on holiday! The constant hammering of the waves soon undermines cliffs, for instance, so that the sea encroaches upon the land and the coast-line becomes completely altered. The construction of protective sea-walls is practically the only method of preventing the evil effects of such encroachment.

Without the aid of mechanical appliances most of the great sea works of the present day would be practically impossible of construction. Foremost among such appliances are cranes of various types and of these the most impressive and at the same time most interesting are the giant block-setting cranes that handle huge blocks as though they weighed pounds instead of tons.

In order to understand the particular work in which these block-setting cranes are employed, we must look a little further into the methods of harbour construction. In the first place, no two breakwaters or harbours are exactly alike, and almost every harbour requires particular treatment.

In some cases a mound of rubble or stone, deposited in a scattered manner and standing above high-water mark, will serve the purpose, as is the case with the breakwater at Algiers, where a rubble mound is protected by 25-ton blocks heaped on the sea bed. In others currents or storms would soon move such scattered material and



A striking photograph of a Titan Crane engaged in work on the harbour at Vera Cruz, showing the friction grip tackle for placing the block in position.

break it down. More elaborate methods are then necessary, such as the ' sack-block ' system. This employs barges with trap doors. The interior of the barge is lined with sacking and in this concrete is deposited. The sides of the sacking are then brought together and laced over the top, and the barges are towed out to the site of the breakwater. The trap doors are then opened and the concrete drops into the sea, where it is solidified by the action of the water and soon becomes a perfectly hard mass. The sack-block method was used in the construction of the underwater portion of the breakwaters at Newhaven and La Guaira, where layers of blocks weighing 100 tons were successfully laid, each extending across the whole width of the breakwater.

When a natural bay is sufficiently sheltered by a projecting headland, it is only necessary to throw a breakwater across the inlet in order to convert it into a harbour. In such a case the entrance would be between the ends of the breakwater and the headland, if the depth of the water there is suitable. Such harbours as these are found at Plymouth and Cherbourg. Sometimes a single breakwater thrown from a projecting point of a bay and enclosing a partly sheltered area of water, is sufficient protection, as at Holyhead, Alexandria and Table Bay. Where no headland or sheltered bay exists in a place where a harbour is required, it becomes necessary to form an entirely artificial harbour, which is, of course, a more extensive project. Such harbours as these are found at Kingston, Madras and, nearer home, at Dover.

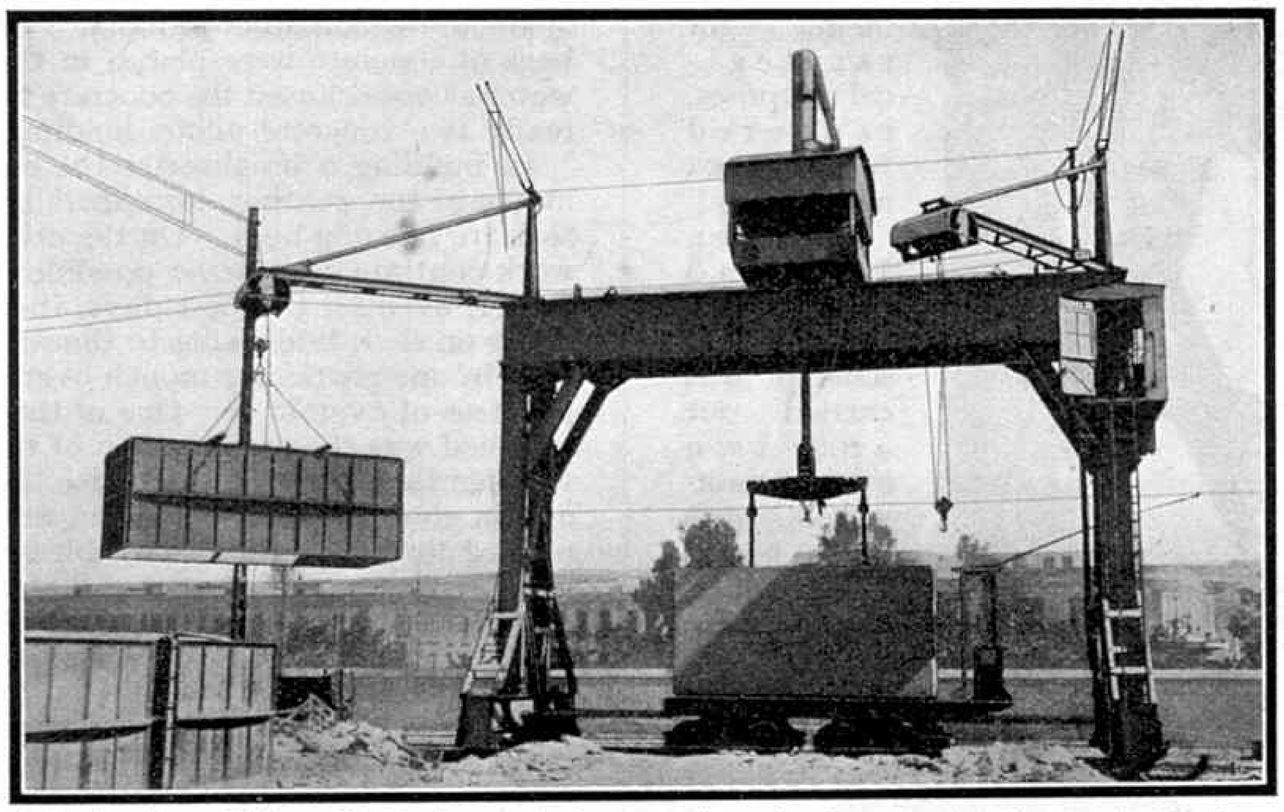
Although breakwaters thus differ in detail in almost every case, they may be broadly divided into three classes according to the method of construction used. These are (1) the rubble stone or concrete-block mound type, (2) the mound type surmounted by a thick wall, and (3) the vertical wall type, in which a solid wall is carried up direct from the sea bottom.

Mound breakwaters are generally formed by depositing in the sea a mass of hard material along the lines previously chosen. Breakwaters of this type are carried a little above high-water level and are placed as squarely as possible to the direction of the heaviest waves, for if placed obliquely the material would soon be scattered. Such breakwaters are generally adopted when an abundant supply of suitable material is close at hand. They are only constructed, however, when the space on the sea-floor that the breakwater will occupy is of no consequence, and where no quay is required to be built.

The mound type of breakwater is well represented by the works at Table Bay and Alexandria. The former breakwater runs in a north-easterly direction from a point to the north of Capetown, and gives shelter from the north-west where Table Bay opens on to the Atlantic Ocean. It consists of a mound of rubble stone, which the sea has now levelled on the ocean side to a gradient of about 1 in 9 for some distance below low water. The original structure, which was begun in 1860, was 2.400 ft. in length. In 1881 an extension was added, bringing the total length of the breakwater to 3,700 ft. The earlier breakwater was in a depth of 30 ft. but the later works extended it into water 50 ft. in depth.

Although this type of breakwater illustrates the simplest possible construction, it requires a large expenditure of material. At Table Bay this material was at hand in the form of stone excavated from a neighbouring site, so that the consideration of transport of the material did not arise.

In the second type of breakwater a rubble mound—similar in many respects to the mound used in the first type—is surmounted by a massive wall. This type is well represented by the Colombo breakwater. The advantages of the mound and wall type are that it requires less material than the mound type and also that the top of the wall may be used as a quay in fine weather. Sometimes this type of breakwater is modified and additional protection afforded by laying large concrete blocks at random on the seaward side, as is the case with the breakwater at Boulogne Harbour, commenced in 1879.



A Gantry Crane lifting a block of concrete from a railway truck preparatory to carrying it down to the building site at the harbour.

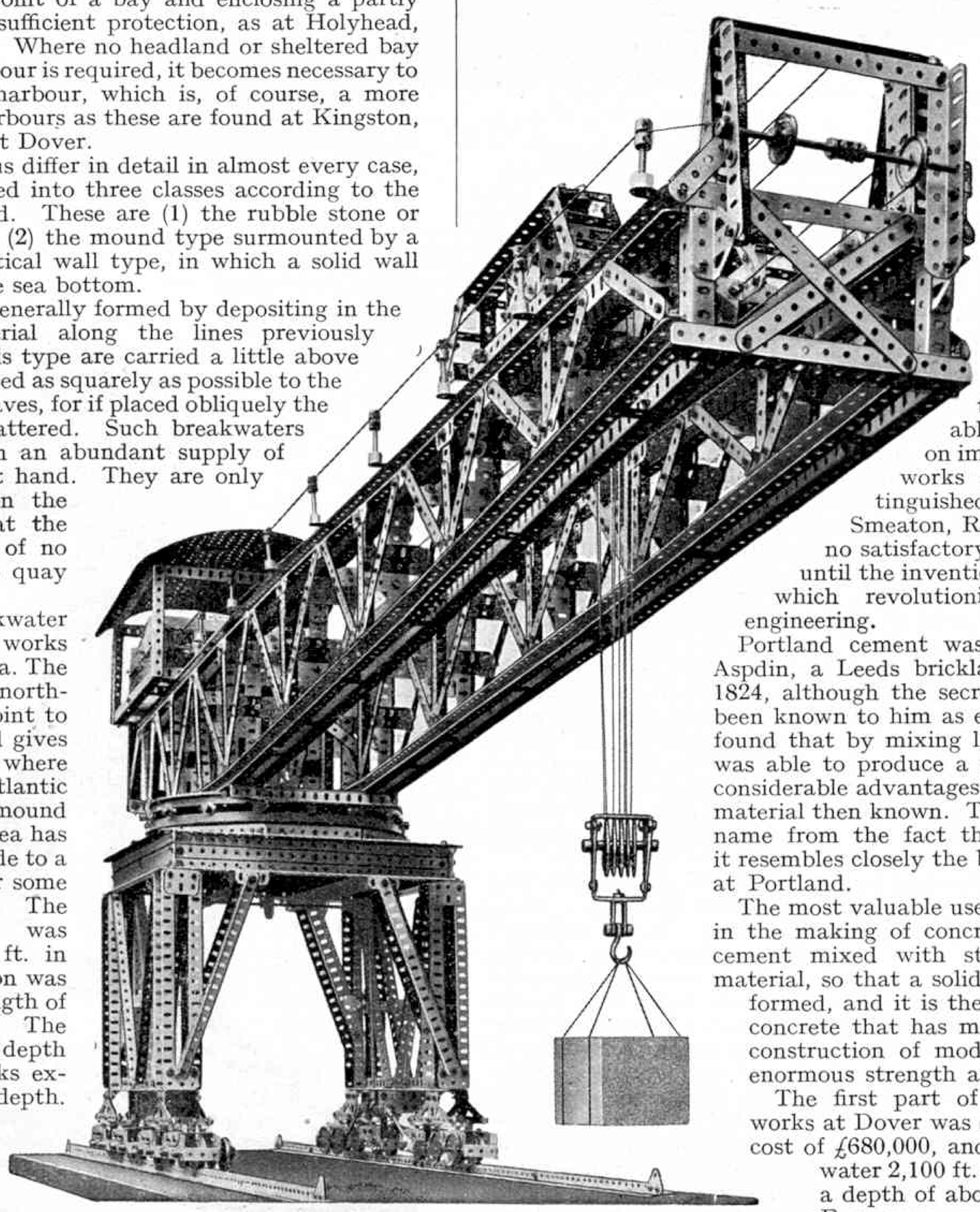
In the third type of breakwater a massive wall is built of blocks of stone, dove-tailed one into the other in order to present the maximum resistance to the waves. Although this type requires less material than either of the others, it necessitates more careful construction and also involves the employment of divers. It is dependent, too, on the existence of a hard sea-floor at the place where it is to be erected, and the depth of the water must not be too great.

By far the most notable example of this type of breakwater is the Admiralty Harbour at Dover. The construction of the massive breakwaters of that great harbour represents the most modern achievement in this particular branch of engineering. From time to time considerable sums had been spent on improving and extending works erected by such distinguished engineers as Perry, Smeaton, Rennie and Telford, but no satisfactory results were obtained until the invention of Portland cement, which revolutionised this branch of engineering.

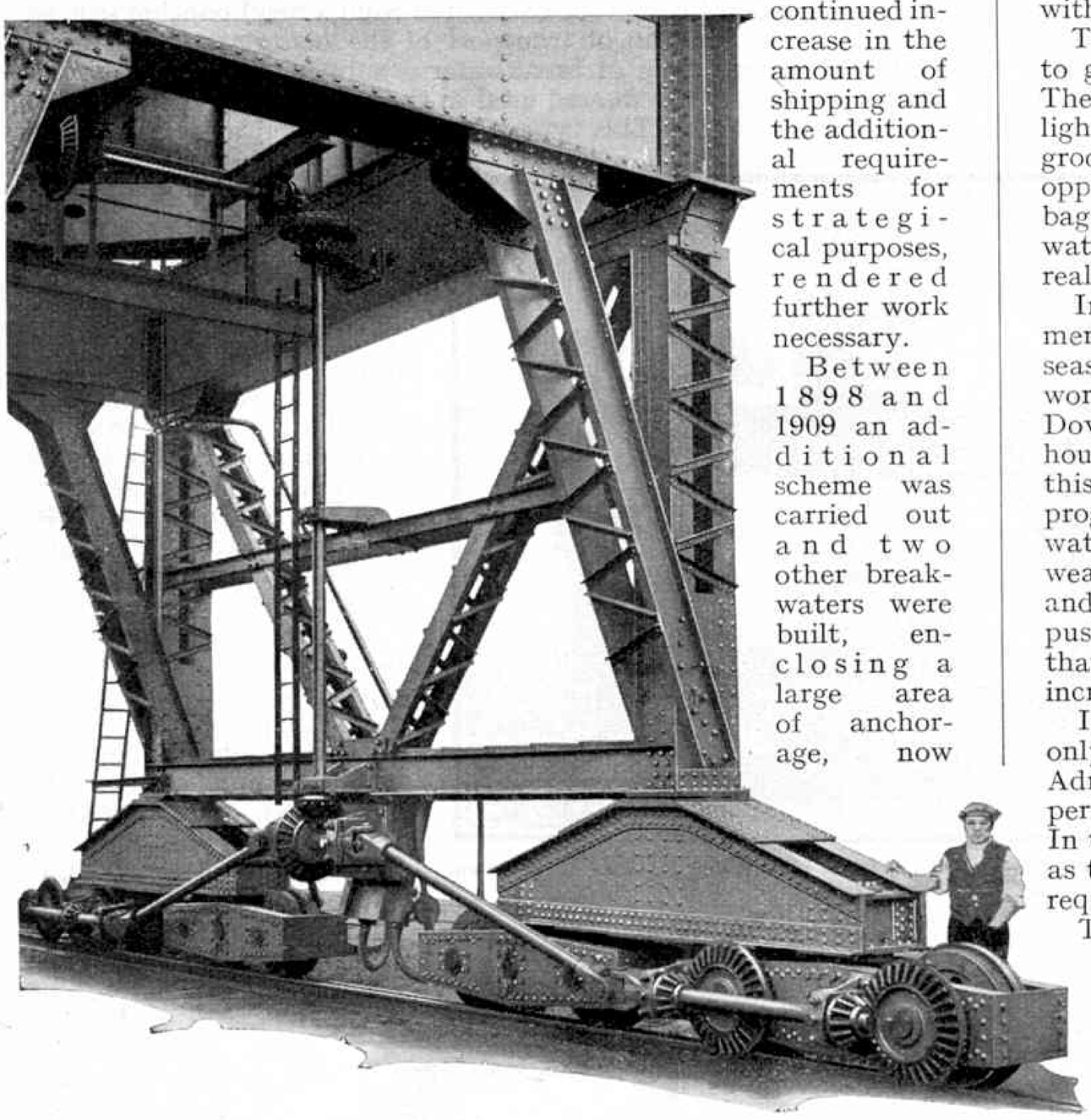
Portland cement was invented by Joseph Aspdin, a Leeds bricklayer, and patented in 1824, although the secret is believed to have been known to him as early as 1811. Aspdin found that by mixing limestone with clay he was able to produce a cement that possessed considerable advantages over any other similar material then known. The material derived its name from the fact that when it sets hard it resembles closely the building stone quarried at Portland.

The most valuable use of Portland cement is in the making of concrete, which consists of cement mixed with stone, sand or similar material, so that a solid mass without holes is formed, and it is the use of large blocks of concrete that has made possible the rapid construction of modern harbour works of enormous strength and extent.

The first part of the modern harbour works at Dover was completed in 1871 at a cost of £680,000, and consisted of a breakwater 2,100 ft. in length, extending to a depth of about 48 ft. at low water. For some years this breakwater served the purpose required, but the



A fine Meccano model of the Titan Crane illustrated on the preceding page. A comparison shows how closely the model follows real engineering practice.



continued increase in the amount of shipping and the additional requirements for strategical purposes, rendered further work necessary.

Between 1898 and 1909 an additional scheme was carried out and two other breakwaters were built, enclosing a large area of anchorage, now known as the Admiralty Harbour, the construction of which was a great engineering feat. We are better able to gain some idea of the magnitude of the task that confronted the engineers when we learn that the total length of the breakwater is over two miles. The finished harbour is over 610 acres in extent and is sufficiently extensive to shelter a whole fleet. The work included the extension of the former breakwater by 2,000 ft., the reclaiming and excavation of a large portion of the chalk cliffs immediately behind the harbour, the building of a new breakwater at the South end, and a new breakwater, 3,850 ft. in length, at the East end.

The breakwaters are between 50 and 60 ft. in width at their bases, and from 80 to 90 ft. in height. They are constructed of 42-ton concrete blocks, which were formed in special block-making yards erected under the shelter of the cliff. These blocks measure 14 ft. by 7 ft. by 6 ft., and consist of a mixture of gravel, sand and cement. This was poured into wooden moulds in liquid form and, when the mixture had set—for which a week was generally required—the sides of the mould were removed and the blocks were ready for transport to the point at which the work was proceeding. For transporting these blocks along the quay huge Goliath cranes were employed. This type of crane, under the name of Travelling Gantry crane, is familiar to all readers from the excellent Meccano models of it that can be built.

The cranes ran on a track supported on a special platform which, in view of the fact that the cranes weighed 100 tons unloaded, was very substantially supported. In the first place, ironshod piles, 100 ft. in length and 20 in. square, were driven into the sea floor in groups of six on each side of the line on which the breakwater was to be built. Each group was separated by a distance of 50 ft. and between the two lines of piles was a clear 70 ft. In all, the scheme required half-a-million cubic feet of timber, which was specially selected by an expert sent over to Tasmania for the purpose.

When the massive piles had been satisfactorily driven home into the sea floor by the heavy blows of the powerful pile drivers, cross-girders were placed from one row to the other. It was necessary to give the structure sufficient strength to withstand the violence of the storms to which it would necessarily be exposed before the work was completed, and accordingly these were then braced diagonally by strong ties and laterally by lattice girders. Finally the heavy timber flooring was laid down upon which the two 100 ft. tracks for the Goliath cranes were to be carried. In effect, therefore, two solid piers had been erected with wooden supports and timbered floors, and braced one with another with cross girders. These enabled the gantry cranes to travel out to the end of the piers and to drop concrete blocks at any desired point between the shore and the pier ends. As the blocks were laid the cranes advanced and so laid succeeding tiers, each tier being built up to the level of the finished breakwater before the next was proceeded with.

The blocks were dovetailed one into the other on all sides, in order to give the breakwater solidity to resist the fury of the waves. They were not dovetailed in the manner used in the building of a lighthouse, but instead were keyed together by cutting semicircular grooves in their faces, it being arranged that these grooves came opposite to each other in pairs. When the blocks were in position, bags of concrete were placed in these grooves. The action of the water at once caused the concrete to solidify, so that each block had really two concrete pillars holding it in position.

In building a breakwater the engineers are very largely at the mercy of the weather, for naturally no work can be done when the seas are running high. On the other hand, when the water is calm work continues whenever possible during both night and day. At Dover, even on the best days, it was only possible to work three hours on each tide owing to the strong currents. Notwithstanding this, in one particular month over 600 blocks were laid, showing a progress of over 75 ft. One of the points that had to be carefully watched was the organisation of the block-making yards. In bad weather they had to be kept free from congestion by unused blocks, and in good weather, when the work on the breakwater was being pushed forward with all possible speed, it was necessary to ensure that they were sufficiently well staffed to be able to cope with the increased demands made upon them so as not to delay the work.

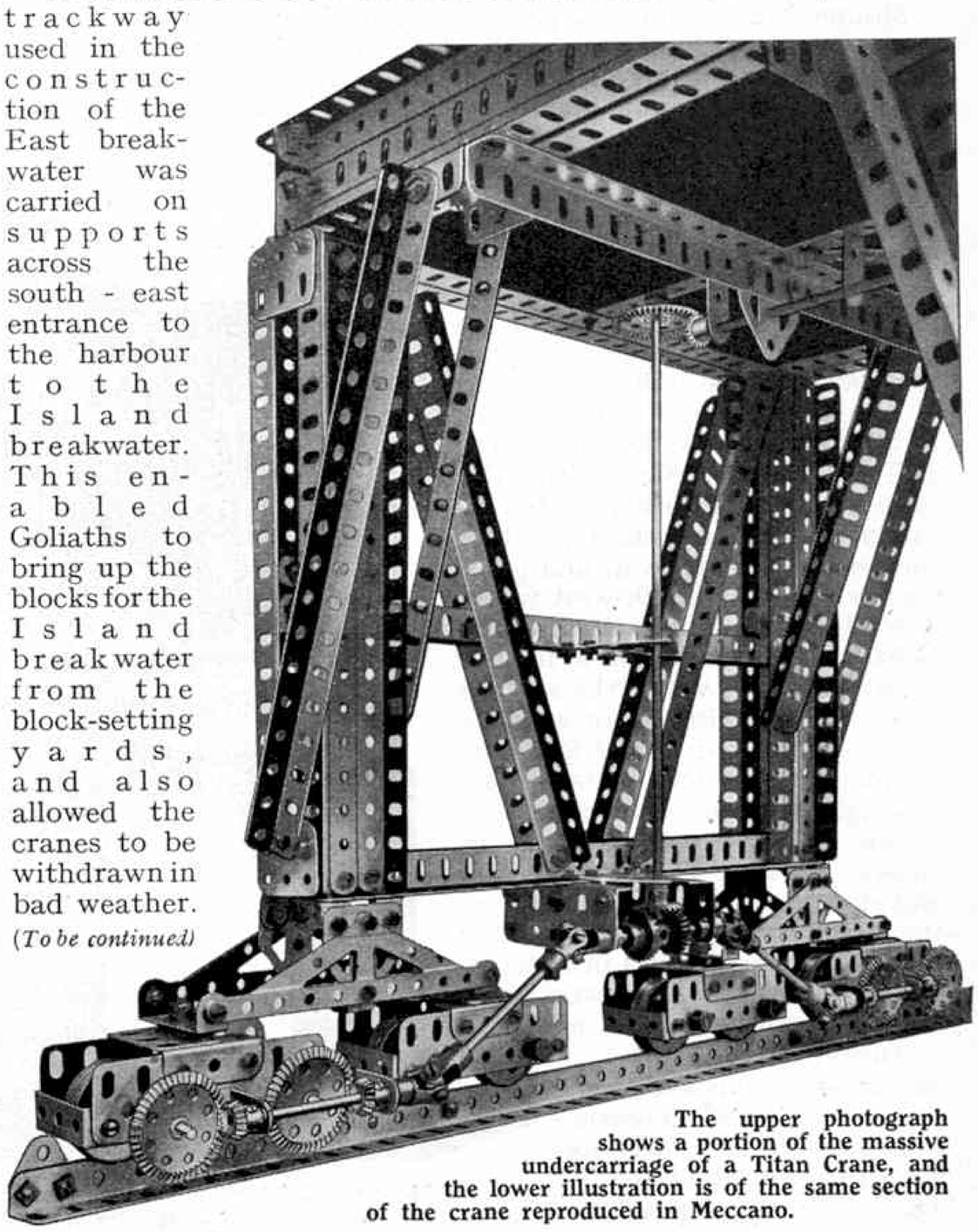
In the construction of the first pier at Dover (completed in 1871) only 91 ft. was built during the first 12 months, but in the new Admiralty Harbour 400 ft. of work was constructed in the same period, showing how great was the advance in harbour engineering. In the new harbour over 1,920,000 tons of masonry were used, and as the blocks averaged about 30 tons in weight, the total number required was about 64,000.

The harbour works included the excavation of a portion of the cliff and it became necessary to build a retaining wall to protect the exposed chalk. This necessitated over 1,000,000 tons of blocks and masonry, in addition to that required by the breakwaters themselves.

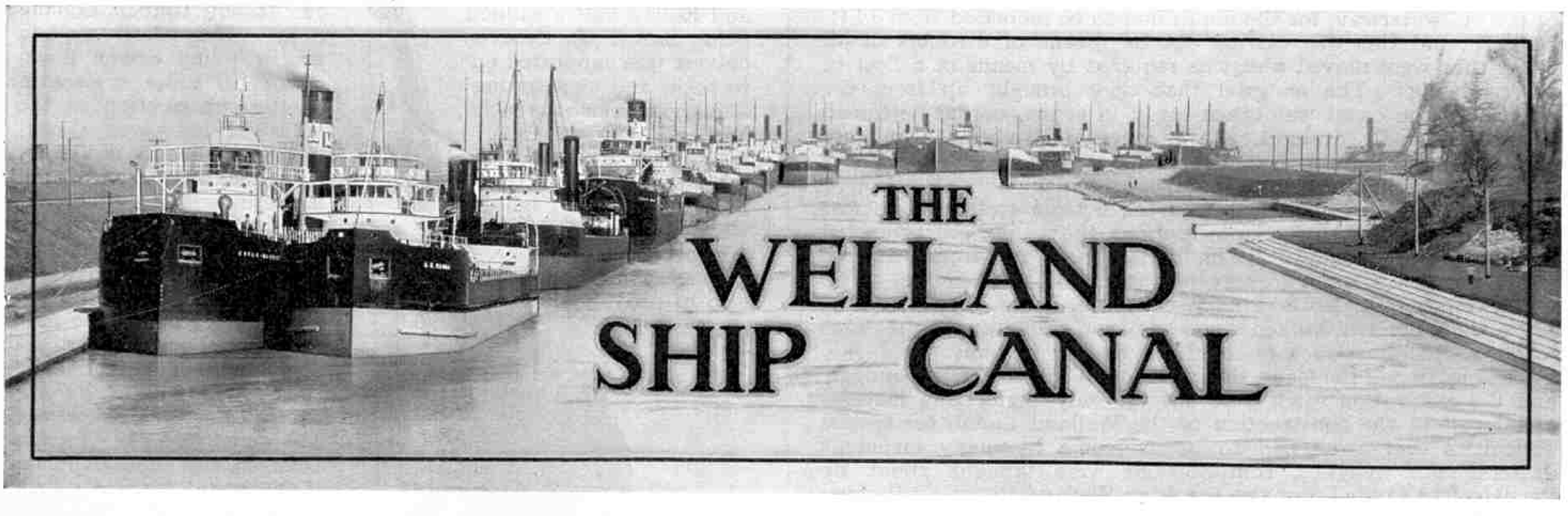
Besides the East breakwater and the Admiralty Harbour extension, another breakwater had to be constructed to complete the scheme. This is quite separate from the two former, and is known as the Island breakwater. In order to save time the engineers decided to build it at the same time as the other breakwaters. To this end they set to work to erect a huge steel frame in the sea at the end nearest to the East breakwater, but before the frame was complete a great storm entirely destroyed it. Six months were required to remove the wreckage.

The steel frame idea was then abandoned, and in its place the trackway used in the construction of the East breakwater was carried on supports across the south-east entrance to the harbour to the Island breakwater. This enabled Goliaths to bring up the blocks for the Island breakwater from the block-setting yards, and also allowed the cranes to be withdrawn in bad weather.

(To be continued)



The upper photograph shows a portion of the massive undercarriage of a Titan Crane, and the lower illustration is of the same section of the crane reproduced in Meccano.



II.—BURYING A RIVER 75 FT. UNDERGROUND

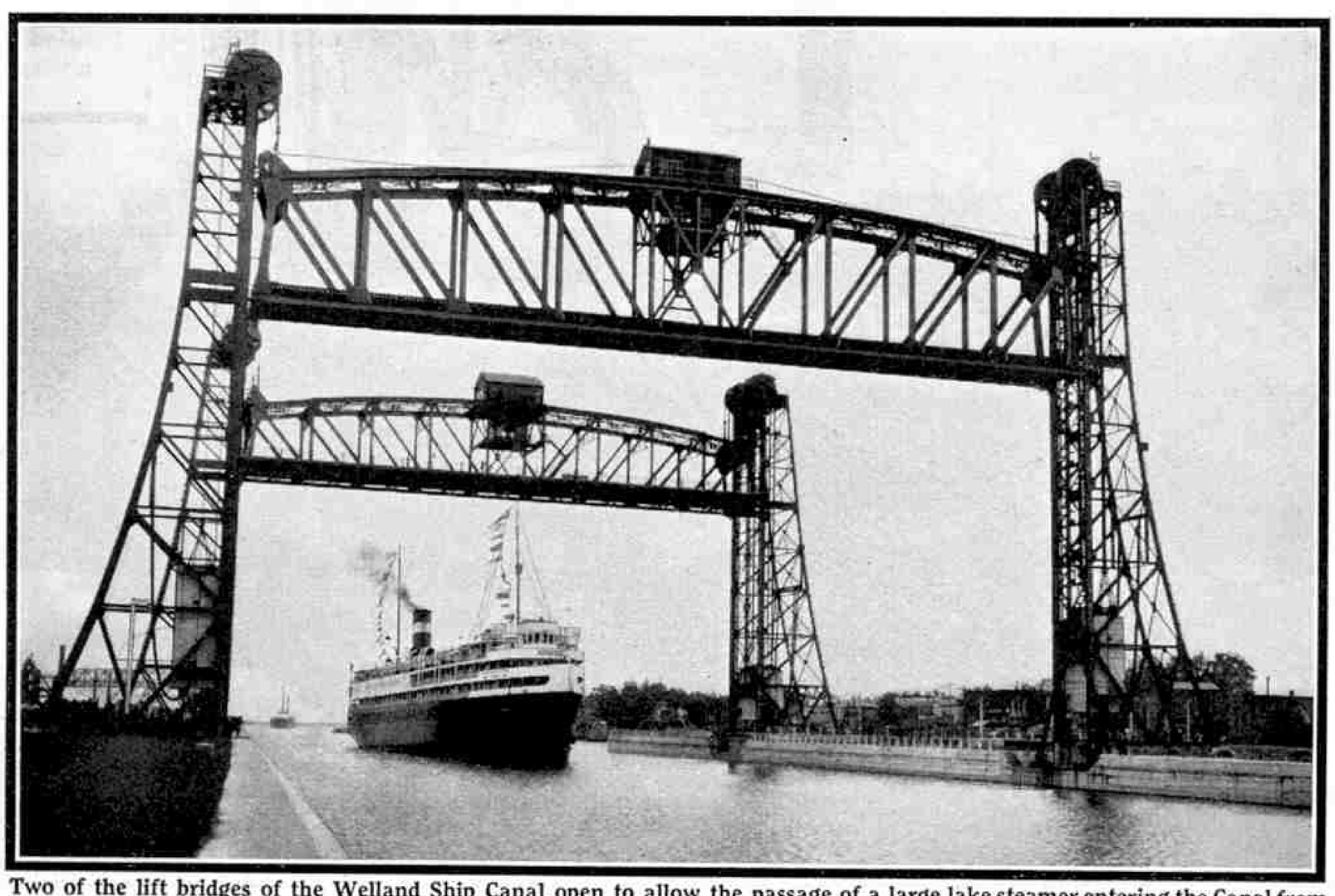
LAST month we described the general course of the Welland Ship Canal and dealt with the construction of the great locks that carry the waterway up the Niagara escarpment separating Lake Erie from Lake Ontario. We also explained the construction of the immense metal gates that retain the water in the locks. In the present article we shall show how many other interesting engineering problems were solved when making the canal navigable by the giant vessels that ply on the Great Lakes.

A very important part of the work of the canal builder is the construction of reservoirs or ponds in which to store the water required when boats are to be worked through the locks. This is especially important in the case of the Welland Ship Canal, for no less than 19,000,000 gallons of water must be poured into one of the seven great lift locks in order to raise a vessel passing through it to the level of the stretch of the canal beyond it. The quantity is sufficient to supply the daily needs of a city of 250,000 people.

The ponds in which the reserve water for the locks of the Welland Ship Canal is stored are on the east side of the waterway. Those serving the three locks nearest Lake Ontario have areas of 107 acres, 200 acres and 150 acres respectively. The twin flight locks are supplied with water from a reservoir 84 acres in area, and a slightly smaller pond has been formed in order to feed the lift lock that crowns the summit of the Niagara escarpment. In certain places the old canal is used as a channel to connect the ponds, and the weirs that regulate the level of the water in the canal and in the reservoirs discharge surplus water into it. These weirs act automatically, their valves opening when the level of the water in the ponds they protect rises above a certain height.

Providing the necessary reserve for the three twin locks on the face of the Niagara escarpment was a difficult task, for the miniature lake required had to be formed halfway up the hillside. The water in it was to be retained by an earth dam, 3,500 ft. in length, which was to rise in places to a height of 80 ft. 6 in. To add to the difficulties the engineers had to overcome, the line of this dam cut right across the existing canal, several of the locks of which were actually destined to be submerged by the water to be accumulated. How the dam was to be built was therefore a problem Traffic over the old canal could not be stopped until the new one was ready, and this could not be completed until the old waterway had been rendered useless by sinking part of it to the bottom of the pond! The puzzle was eventually solved by constructing a temporary dam across the pond, making part of it available for supply purposes; and the change from the old canal to the new one was made without interruption to traffic. The main dam and its control weir will be completed in the near future.

The construction of the canal involved a stupendous amount of excavation, more than 60 million cu. yds. of earth and rock being dug out along its track. This quantity is sufficient to form a pile six times the size of the Great Pyramid, and in removing it the excavating crews did as much work as if they had dug a hole 7 ft. in diameter through the centre of the earth from Canada to Australia!



Two of the lift bridges of the Welland Ship Canal open to allow the passage of a large lake steamer entering the Canal from Lake Erie. There are 20 bridges across the Canal, and 10 of them are similar in type to those shown in our photograph. We are indebted to the courtesy of the Department of Railways and Canals, Canada, for the illustrations to this article.

The excavating plant employed consisted of steam shovels and draglines, in addition to locomotive cranes and other dragline machines handling clam shell buckets. Most of the dry material was dug out by means of mechanical shovels of all sizes, ranging from small machines equipped with caterpillar tracks to large 90-ton steam shovels capable of holding five cubic yards. Good use also was made of the dragline shovels, and those employed were remarkable for their size. The bucket of one of them had a capacity of five cu. yds. and at the time was the largest in Canada.

The dry material excavated was carried away in dump cars of all kinds, including narrow gauge wagons holding 4 cu. yds. of earth, and others, made of steel and running on track of standard width, that carried 20 cu. yds. A special railway was built and operated by the Government in order to remove the material dug out. This ran from the twin flight locks to the terminus on Lake Ontario and was about 7½ miles in length. It was equipped with a complete block signalling system, and as many as 384 trains were dealt with daily when excavation was in full swing.

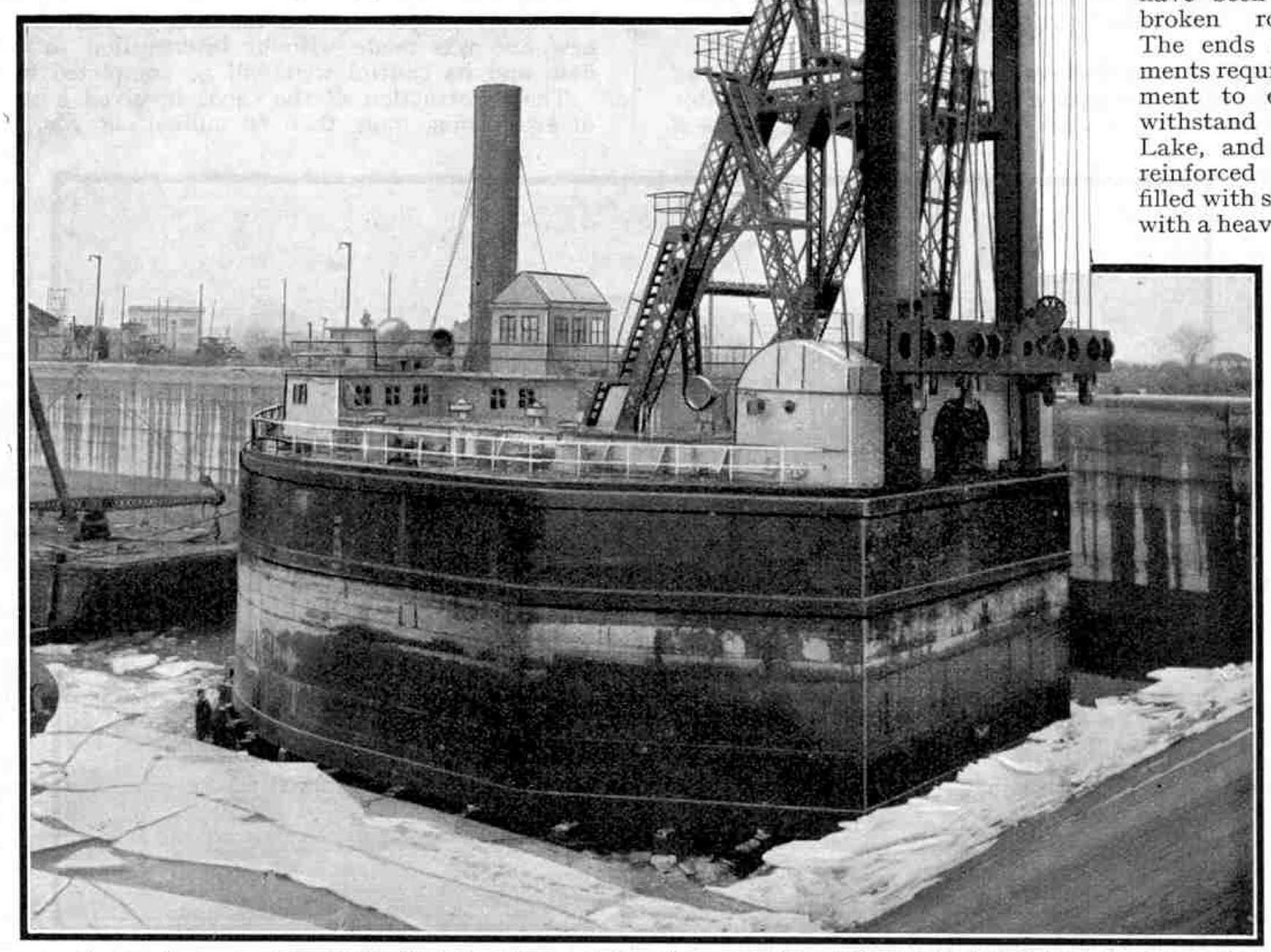
Dredging was necessary where the new canal follows the line

of the old waterway, for the depth had to be increased from 14 ft. to 30 ft., and this was carried out by means of dredgers of all types that were moved about as required by means of a fleet of powerful tugs. The material that they brought up from the bottom of the canal was taken away in scows, or flat-bottomed vessels of small draught. Large suction dredgers also were employed, and these delivered their material to specially prepared dumps in the vicinity of the canal.

The canal is 200 ft. in width on the bottom and 310 ft. across on the water line. In certain sections the banks are protected by a concrete wash wall 12 in. in thickness and from 16 ft. to 18 ft. in width in order to prevent damage by wave action. This wall extends to a depth of more than 7 ft. below the water line, but a thick layer of broken stone has been substituted in sections where a concrete structure could not readily be built.

The building of the locks, the provision of the necessary pondage, and the excavation work were not the only engineering features of interest in the construction of the Welland Canal, for special difficulties that arose had to be overcome by many ingenious devices. For instance, complications were brought about by the existence of the Chippawa Creek, or Welland River, a tributary of the Niagara River that is crossed by the Canal. For a certain distance the level section of the canal above the Niagara escarpment roughly follows the line of the Creek, and at one point the stream had to be diverted into a new bed dug out for it in order to give the space required for widening the existing canal.

The greatest difficulty on this section of the work was encountered at Welland. This city is situated on the canal about halfway between Lakes Erie and Ontario, and it is there that the Creek actually crosses the canal. The old waterway was carried over the stream by means of an aqueduct, for it was only 14 ft. in depth. The same principle has been followed in dealing with the new canal, but owing to its greater depth it became necessary to bury the Creek underground in what is described as an inverted syphon. The water of the creek now flows under the artificial waterway through six great concrete tubes, each of which is 22 ft. in diameter. These are 75 ft. below the surface, and the water of the creek reaches them and flows away again by means of gigantic vertical shafts that have been sunk at their ends.



The giant floating crane of the Welland Ship Canal in dry dock. It is employed to lift the leaves of the gates of the locks on the Canal from their hinges when these require repair or renewal. Leaves weighing 490 tons may be raised at a speed of 18 in. per minute.

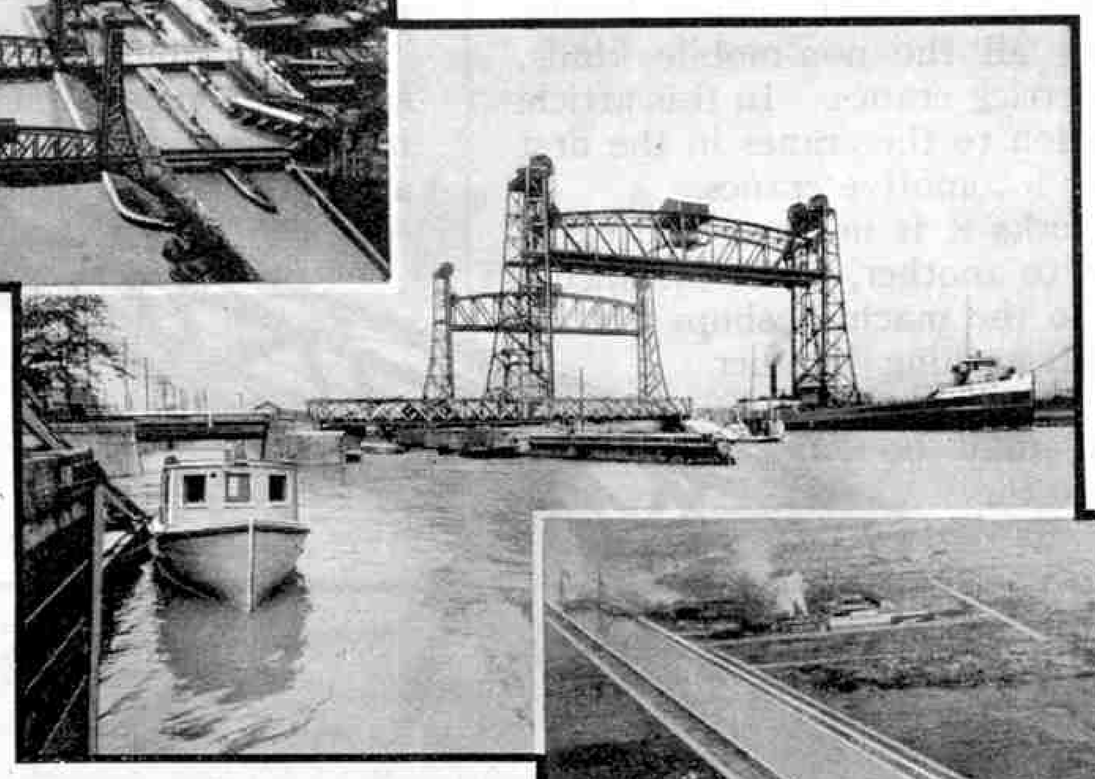
To-day there is little indication of the magnitude of the task involved in constructing the inverted syphon through which the Chippawa Creek flows, for all the evidence is underground. In reality the syphon was only completed after a terrific struggle with tremendous earth pressures. The ground in which it was constructed proved to be mostly a soft clay, more or less mixed with sand and gravel, and in parts could almost be described as quicksand. Although the greater part of the area was enclosed by a steel sheet pile cellular cofferdam, the pressure was so great as to deflect the piling to a maximum distance of 4.5 ft. at the top. The excavation for the syphon was done in comparatively small sections within the cofferdam, but the pressure to contend with was so great that square baulks of timber 18 in. in thickness used as struts were crushed by it. The work was continued to completion, however, more than 8,000 tons of steel sheet piling and nearly half a million cu. ft. of timber bracing being used in the excavation. The whole syphon culvert was supported on timber piling driven down to rock, and aggregating nearly 50 miles in length, as the construction of the work that is only indirectly associated with actual canal making. It was found necessary to build harbours with great breakwaters at each end of the canal in order to give approaching boats a properly-dredged channel through which to reach the artificial waterway, and also to provide shelter for the canal works during stormy weather. The harbour of Port Weller, at the northern end of the canal, was formed by enclosing an area of about 150 acres of Lake Ontario between two embankments that extend to a distance of nearly a mile and a half from the shore. The harbour itself is more than a mile in length and is 400 ft. in width at the entrance. The material excavated during the enlargement of the old canal was used to form the great walls, which have been reinforced with broken rock protection. The ends of the embankments required special treatment to enable them to withstand storms on the Lake, and they consist of reinforced concrete cribs filled with stone and covered with a heavy concrete superstructure.

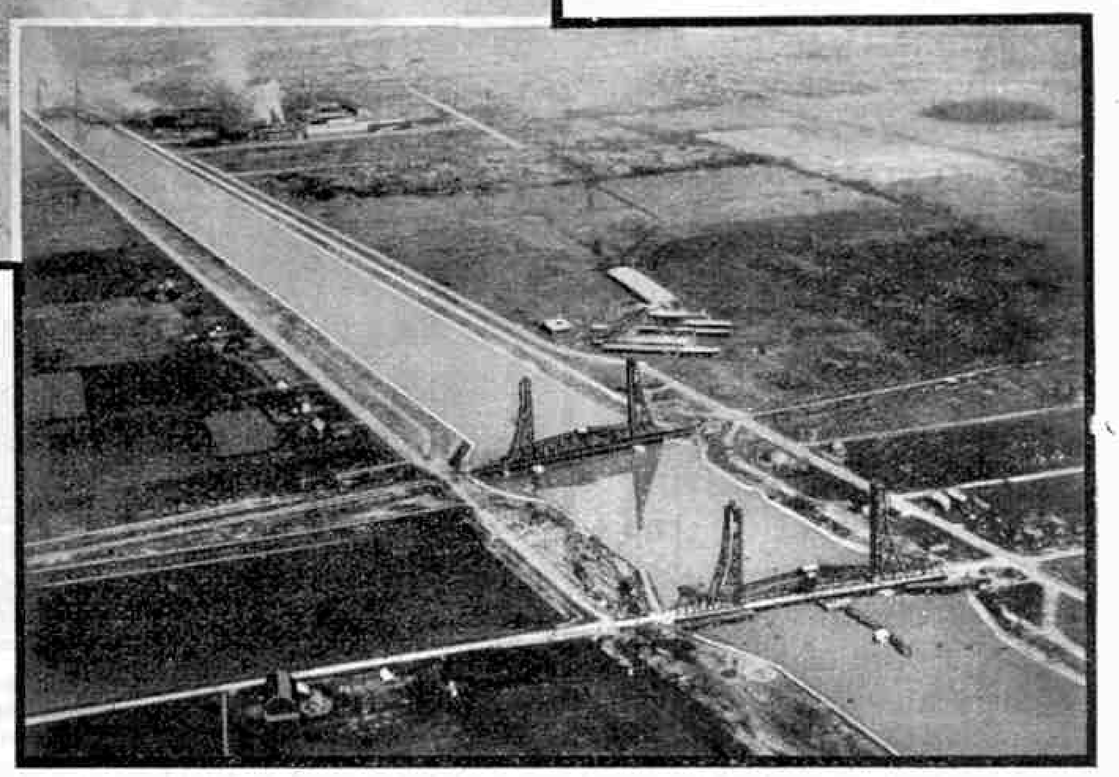
Work at Port Colborne was simpler than at Port Weller, for the harbour already existed, as it formed the Lake Erie terminus of the old canal. The channel entrance and the harbour itself were dredged to a depth of 27 ft. and a new breakwater 2,000 ft. in length was built. This extends from one of the old breakwaters, which themselves are 4,400 ft. from the shore, and provides protection against the south-west gales that sometimes rage across the Lake.

One very important branch of the work was that of designing and building new bridges. The isthmus crossed by the canal is only 25 miles in width, but it offers the only means of communication by land between Canada and the United States over a section of the frontier nearly 500 miles in length. It is therefore well developed, and is traversed by an unusually large number of busy roads and railways. With one exception, the structures by means of which these were carried across the former waterway were not long enough to cross the new canal, and in addition the new canal did not occupy the same position as the old one throughout its entire length. New bridges were necessary, therefore, and 19 of these have been erected, the construction of another new bridge having been held over until traffic conditions make its erection necessary. They provide a clear headway of 120 ft. and are of three different kinds. Most of them are of the vertical lift type,

10 of the bridges actually erected being built in this manner; while of the remainder two are swing bridges and seven are of the rolling lift type, these including both single leaf and double leaf bascule bridges. Illustrations of bridges of the vertical lift type accompany this article, and in them these structures are shown in the open and closed positions.

Many of the bridges are remarkable structures. For instance, the bridge that carries Main Street, Welland, across the canal, has a width of 30 ft. and its piers are 216 ft. 4 in. apart. It is of the vertical lift type, and the total weight of the moving span and the counterweights that descend as the roadway rises is 2,300 tons. There are 12 other bridges with spans of over 200 ft., and the weights of the moving parts of three of these are more than 2,000 tons.





Three views of the Welland Ship Canal. The one at the top shows the two lift bridges at Port Colborne at the entrance to the Canal from Lake Erie. In the centre the bridges at Port Colborne are shown open to allow vessels to pass through on their way to Lake Erie. On the right a straight section of the Canal is seen. The two bridges, shown in the closed position, carry a road and one of the tracks of the Canadian National Railways across the waterway.

Like the lock gates, all the parts are operated by electric motors, and these are capable of opening them to their full extent in a minute and a half. Petrol motors also are provided for this purpose, but these will only be brought into use in the rare event of a failure of the current supply.

The electric current required for operating the lock and bridge machinery, or for heating and lighting purposes, will be supplied by a hydro-electric power plant that is being completed on the west bank of the canal at the foot of the flight or twin locks. The necessary supply of water is to be brought from the level section of the canal beyond the lock that marks the top of the Niagara escarpment. It will reach the station through a reinforced concrete penstock 8 ft. 6 in. in diameter, that is built in the west walls of the flight locks by means of which the canal is carried up the face of the escarpment. The lower section of the penstock is lined with steel plates, and the giant tube is more than a mile in length and gives a head of 186 ft. The flow of water through it will be controlled by means of a motor-operated sluice gate at the intake, and a steel surge tank will be provided in order to avoid great changes in pressure.

The equipment of the power station includes three vertical shaft turbines each of 5,000 h.p., driving generators providing current at 6,600 volts, which is then stepped up to 22,000 volts for distribution. A transmission line runs from end to end of the canal on its west side, and sub-stations have been erected where necessary in order that the pressure of the current supply may be reduced to the 550 volts at which it is normally used. The entire length of the canal is lighted, for vessels pass through by day and night during the busy navigation season. Powerful lamps are placed 160 ft. apart on both sides of the locks, but a distance of 200 ft. is allowed between those on the approach walls, and on the long stretches of the canal lamps are placed at intervals of 450 ft. The lighting units between the locks are fixed on the poles of the transmission system and are sufficient to give adequate illumination without causing glare.

The use of powerful electric machinery enables the work of passing vessels through the locks to be carried out smoothly and quickly. In the control cabin of each lockmaster is an indicator on which are glowing lights that tell him the exact position of every valve and gate in his charge, and the controls are so interlocked that the levers in front of him can only be used in their correct order. A mistake is therefore practically impossible.

Occasionally accidents may occur, of course, and it is necessary to prepare for emergencies. For instance, boats may carry away lock gates, or so damage them that they are no longer watertight, and in order to enable the service to be maintained some means of replacing them speedily is then necessary. For this reason eight spare leaves have been built. These were erected in one of the locks, and when they were ready sufficient water was introduced to enable them to float in a horizontal position. They were then towed to a special dock or gate yard constructed at Port Weller, where they were placed in a horizontal position on concrete pedestals, and there they will remain until it is necessary to transport them to one of the locks in order to cope with an emergency. The gateyard is provided with filling and emptying valves and may be used as a dry dock for the repair of damaged gates.

Even if an accident occurs there is little risk of any serious results, for means of controlling flood water are taken immediately. For instance, if the gates at the top of the Niagara escarpment should refuse to close properly, or should be carried away, the guard gate a little further along the level stretch could be closed in order to hold back the water contained in it, and when necessary the valves in the safety weir adjoining the guard gate can be closed immediately by turning a switch.

In addition to the spare gates, the gate dock can also house the electric pontoon gate lifter, which is kept during the navigation season in a special dock, below the first lock, which also accommodates a pair of lower gate leaves. The gate lifter is a gigantic floating crane of special construction, capable of lifting a load of 500 tons. Its purpose is to remove any gate leaf that has become damaged, or for some other reason requires renewal, and to lower into its place a new leaf brought from the gate yard at Port Weller, where the spare leaves are held in reserve.

The pontoon is 90 ft. in length, and has a width of 66 ft., while its loaded draft is 20 ft. It is the largest structure of its kind in the world, and is a self-contained unit, current for the lifting machinery being generated on board. It does not supply its own motive power, however, being towed from place to place as required by tugs. As will be seen from our illustration, it is curiously shaped. This is due to the necessity for manœuvring it in narrow waterways, and also to the fact that it must be taken very close to any gate it is intended to lift, for this must be hoisted vertically, no swinging over being allowable. The forward end of the pontoon has therefore been made blunt and straight, and it is there that the hoisting mechanism has been placed.

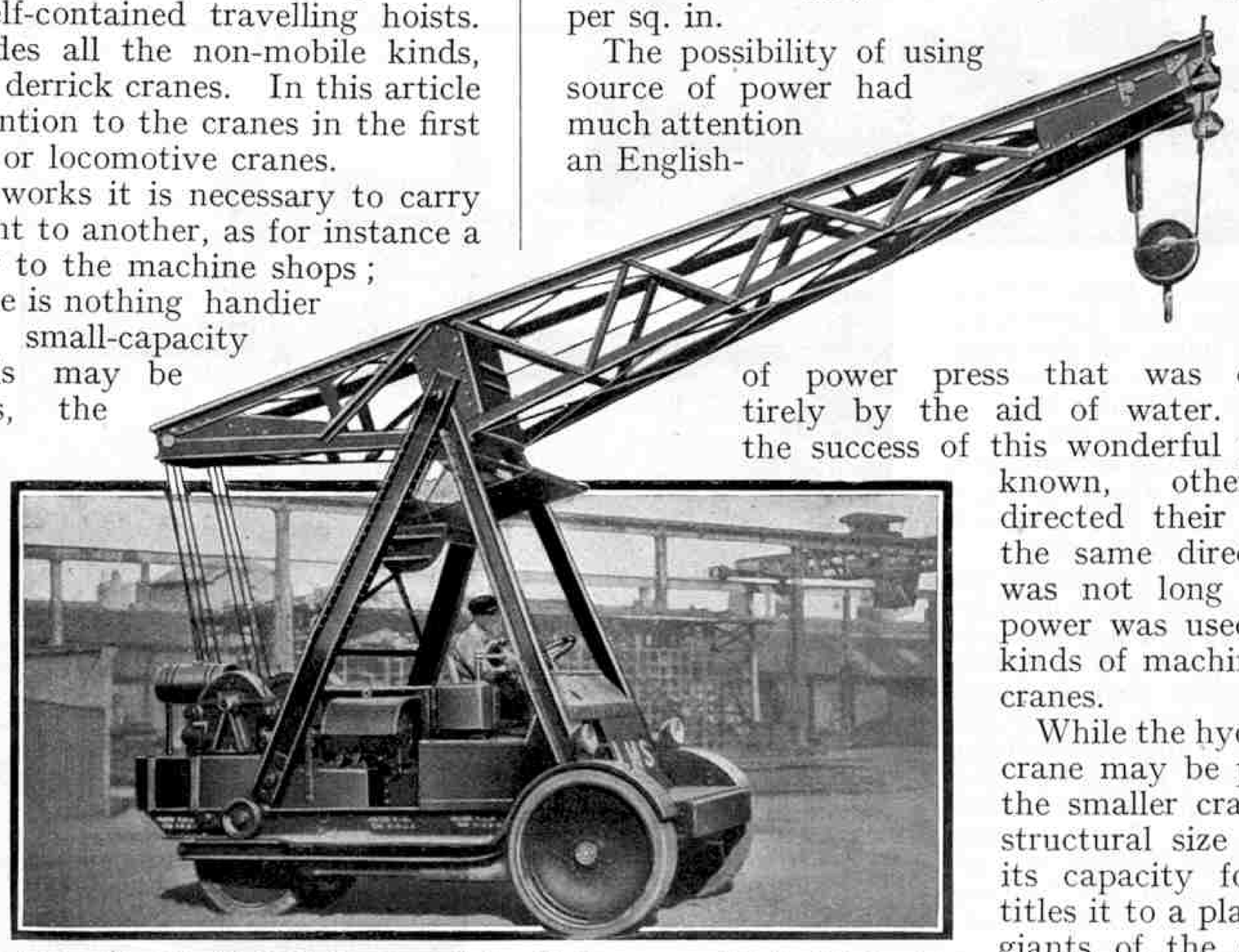
The frame used for lifting consists of two columns suitably stayed and braced. Across the top is a girder carrying eight sheaves or pulley wheels each 9 ft. 6 in. in diameter, and eight smaller sheaves are carried in a frame on the back and at the base of the lifting frame. The ropes, eight in number, pass over the upper set of sheaves and down to the lower set, where their direction is changed to horizontal. After this they pass along the intermediate deck of the pontoon to sheaves on travelling carriages, which are moved fore and aft by large double-headed screws, 9 in. in diameter and 50 ft. in length, which are rotated by electric motors. *(Continued on page 860)*

Modern Mobile Cranes

An Interesting Petrol-Electric Machine

THE use of cranes for all kinds of handling and transporting work to-day is almost universal, and therefore it is interesting to know something of the various types of these machines, which save so much time and money. For convenience of description cranes may roughly be divided into two main groups, of which the first and probably the most important, both as regards application and number, is the locomotive or mobile type. In this group are included many kinds of cranes which, while differing from each other in many respects, all possess the ability to travel from place to place, and are really self-contained travelling hoists. The second group includes all the non-mobile kinds, such as hammerhead and derrick cranes. In this article we are confining our attention to the cranes in the first class, that is, the mobile or locomotive cranes.

In almost every large works it is necessary to carry loads from one department to another, as for instance a casting from the foundry to the machine shops; and for this purpose there is nothing handier or more suitable than a small-capacity travelling crane. This may be one of several types, the commonest being the revolving, short jib, steam or electrically-driven crane. These small mobile cranes have a lifting capacity varying within fairly wide limits, and their power is derived usually from a boiler and engine mounted on a revolving superstructure, the boiler generally being of the vertical fire-tube type. Some of them are electrically driven, however, and these either carry their own batteries from which to obtain the supply of current, or receive the supply from an exterior source by means of a flexible cable attached to the frame and trailing along behind, or from rails on which the crane travels. In the latter case the electric circuit is completed through the road wheels, which are in direct electrical communication with the motors contained in the superstructure of the crane, and a conductor rail or overhead wire.



A 6-ton Petrol-Electric Mobile Crane manufactured by Ransomes and Rapier Ltd., Ipswich, to whom we are indebted for our illustrations. The machine is fitted with a self-contained power unit and is adaptable to an almost unlimited number of uses.

Although the steam and the electric portable cranes are the most popular, there are two other types that are equally interesting and efficient —the pneumatic and the hydraulic cranes. The pneumatic or air-driven cranes are seldom used, however, owing to the necessity for special air compressors to provide the driving power. They are usually seen in large engineering shops and shipyards where compressed air is employed for a number of purposes, such as working riveting hammers, drilling machines, etc. The necessary power is developed by a small air engine designed specially for high speed. The compressed air enters the cylinders through ports arranged very similarly to those in an ordinary steam engine, the only difference being in the amount of lap or lead of the valve. As compressed air has no expansion factor such as steam possesses, the air enters the cylinders throughout the whole of the stroke, the pressure thus remaining constant. These air-driven engines revolve at a great speed, and develop considerable power when their size is compared with a steam engine. The pressure of the air supply is usually something like 60 lb. per sq. in.

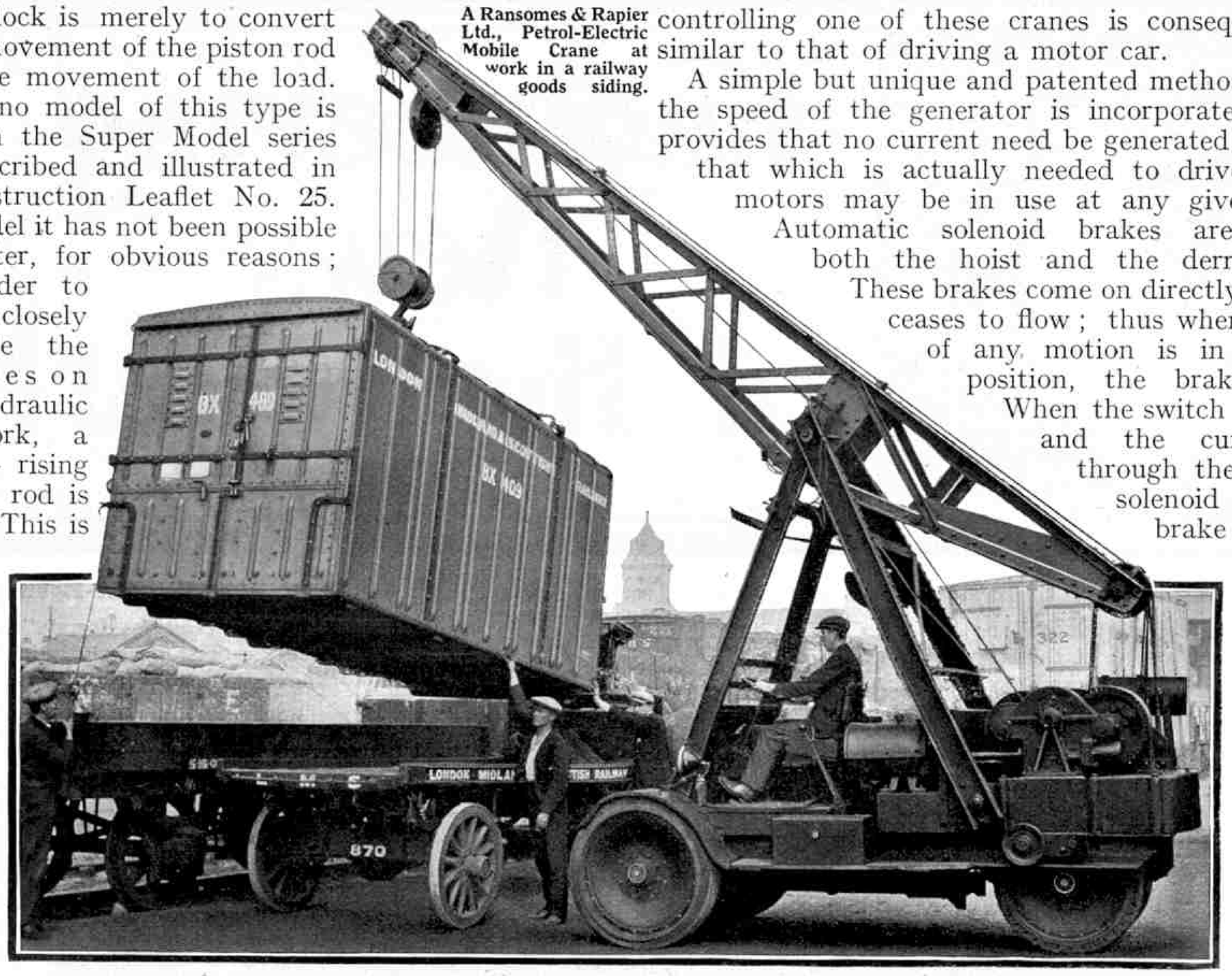
The possibility of using water as a source of power had not received much attention until in 1795 an English-man, Joseph Bramah, the famous engineer, invented a new type of power press that was operated entirely by the aid of water. As soon as the success of this wonderful press became known, other engineers directed their activities in the same direction, and it was not long before water power was used to work all kinds of machines, including cranes.

While the hydraulic mobile crane may be placed among the smaller cranes as far as structural size is concerned, its capacity for lifting entitles it to a place among the giants of the crane family. The prodigious force that is exercised by a hydraulic cylinder can only be appreciated when the machine is seen actually at work, and yet the control of this tremendous power is so simple that a boy could easily manage such a machine.

The mechanism of a hydraulic crane consists primarily of a large strong cylinder, inside which works an accurately fitted piston, or plunger as it is more correctly termed. A comparatively small bore forcing pump is arranged to communicate with the bottom of the cylinder, and by operating the pump—by hand or otherwise, according to the size of the crane—small quantities of water may be forced in succession under the piston in the cylinder, thus gradually raising it. The piston rod carries at its upper end a set of pulleys, which are connected to a second set by means of chain or rope so as to form a purchase block. The free end of the chain or rope is attached to the load hook, and as the piston slowly rises it forces the two sets of pulleys farther apart, with the result that the load hook is raised. The object of the

purchase block is merely to convert the small movement of the piston rod into a large movement of the load.

A Meccano model of this type is included in the Super Model series and is described and illustrated in Special Instruction Leaflet No. 25. In this model it has not been possible to use water, for obvious reasons; but in order to illustrate as closely as possible the principles on which hydraulic cranes work, a vertically-rising and falling rod is provided. This is driven by Meccano screw mechanism, and its movement corresponds exactly to the movement of the ram or hydraulic piston rod.

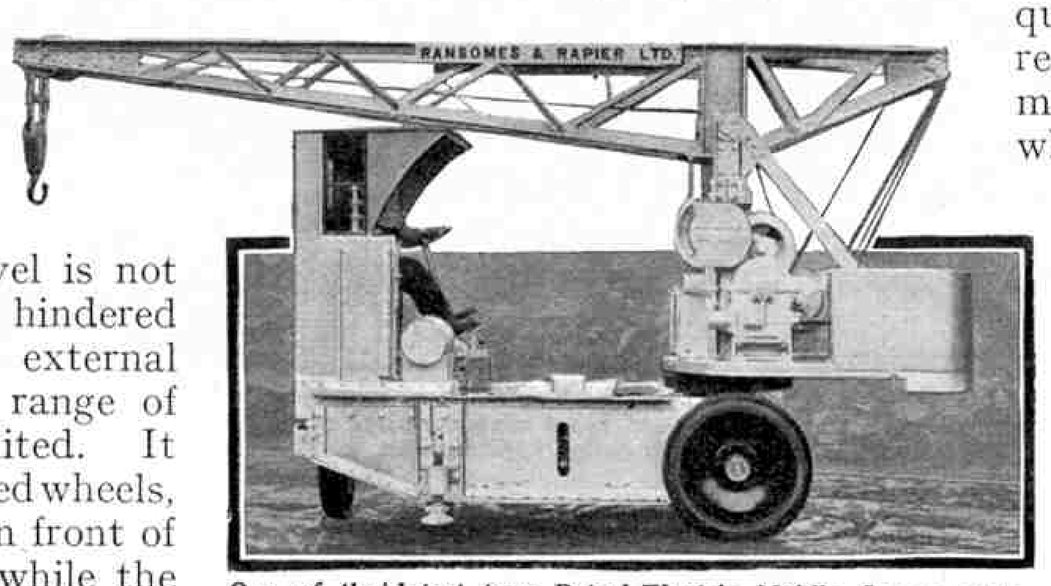


A Ransomes & Rapier Ltd., Petrol-Electric Mobile Crane at work in a railway goods siding.

During the past few years mobile cranes have been made that are operated by petrol or Diesel engines, a source of power that has been found highly satisfactory, especially for cranes of 30-40 tons capacity.

One of the most interesting of the various types of mobile cranes is undoubtedly the petrol-electric crane. A crane of this type manufactured by Ransomes & Rapier Ltd., of Ipswich, is shown in the illustrations to this article and also on our cover, and a realistic Meccano working model appears on page 869.

The Ransomes & Rapier crane comprises an entirely self-contained power unit, and combines the stability and efficiency of a stationary crane with extreme mobility. Its travel is not confined to a set of rails, or hindered by trailing cables from an external power supply, so that its range of utility is practically unlimited. It runs on four solid rubber-tyred wheels, two of which are mounted in front of the crane on a fixed axle, while the other two, which are driven and also the steered wheels, are mounted on a castor that is pivoted to a post in the tail of the machine.



One of the latest type Petrol-Electric Mobile Cranes with jib lowered ready for travelling.

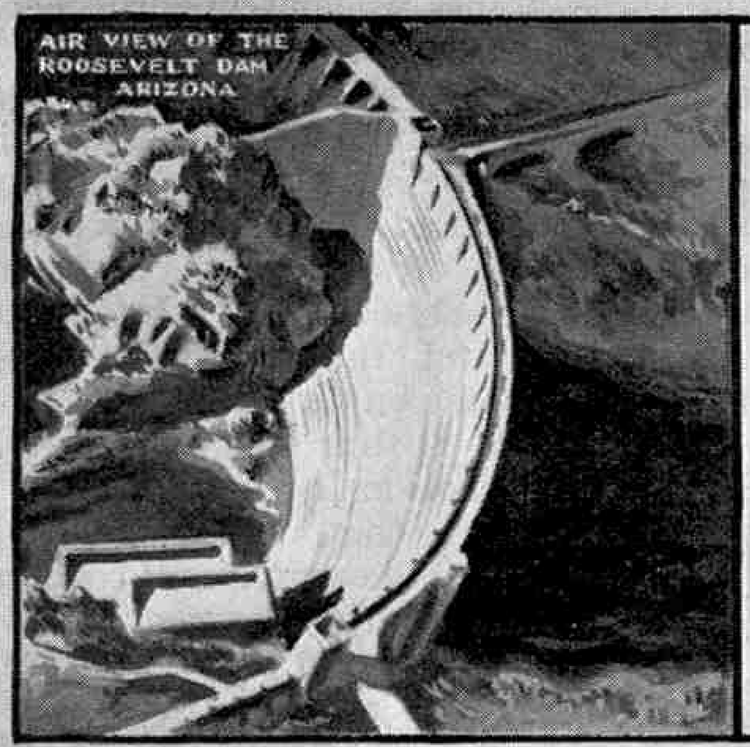
The power unit consists of a petrol engine, which drives a generator that supplies current to the luffing and hoist motors, and to the two traction motors incorporated in the "castor." The crane is slewed by rotation of the pivoted castor, which is connected to an orthodox steering wheel placed in front of the operator's seat; and the luffing, hoisting, and travelling operations can each be brought into play by the movement of levers placed within easy reach of the operator. The task of controlling one of these cranes is consequently very similar to that of driving a motor car.

A simple but unique and patented method of varying the speed of the generator is incorporated, and this provides that no current need be generated in excess of that which is actually needed to drive whichever motors may be in use at any given moment. Automatic solenoid brakes are fitted to both the hoist and the derrick motors. These brakes come on directly the current ceases to flow; thus when the switch of any motion is in the "off" position, the brakes are on. When the switch is thrown in and the current flows through the motor, the solenoid draws the brake off. Limit switches are fitted to the jib and to the hoist, to prevent either the hoist over-running or the jib being elevated or lowered beyond a certain point in order to avoid strain on the gears.

By manipulation of the steering wheel, the castor post and castor, mounted under the tail of the crane, can be turned through a right-angle, in either direction, from the "travel ahead" position. By this means the crane can be made to travel either straight ahead or in a curve of any radius, or to rotate about the mid-point of its front axle.

As the castor axle is articulated, the load is always equally borne on the two driving wheels, and consequently the torque exerted is correctly shared by the two travel motors, each of which drives one wheel. This articulation of the castor enables the back wheels to adjust themselves to uneven ground, and thus the crane is virtually supported on the three point suspension principle.

The Meccano model of this interesting machine shown on page 869 reproduces all the operations of the actual crane, with the aid of a single Meccano 6-volt Motor and an ingenious gear-box. As in the original, the model is fitted with a limit switch to prevent overwinding of the jib, an automatic brake on the hoist shaft, and foot brakes on the luffing and road shafts. The constructional details of the model are described in Instruction Leaflet No. 20, Mobile Crane. The drive from the 6-volt Electric Motor is transmitted to the castor axle through simple Pinion and Contrate Meccano gearing. The model is quite easy to build from the directions given and is an excellent example of a modern light mobile crane.



Engineering News of the month.

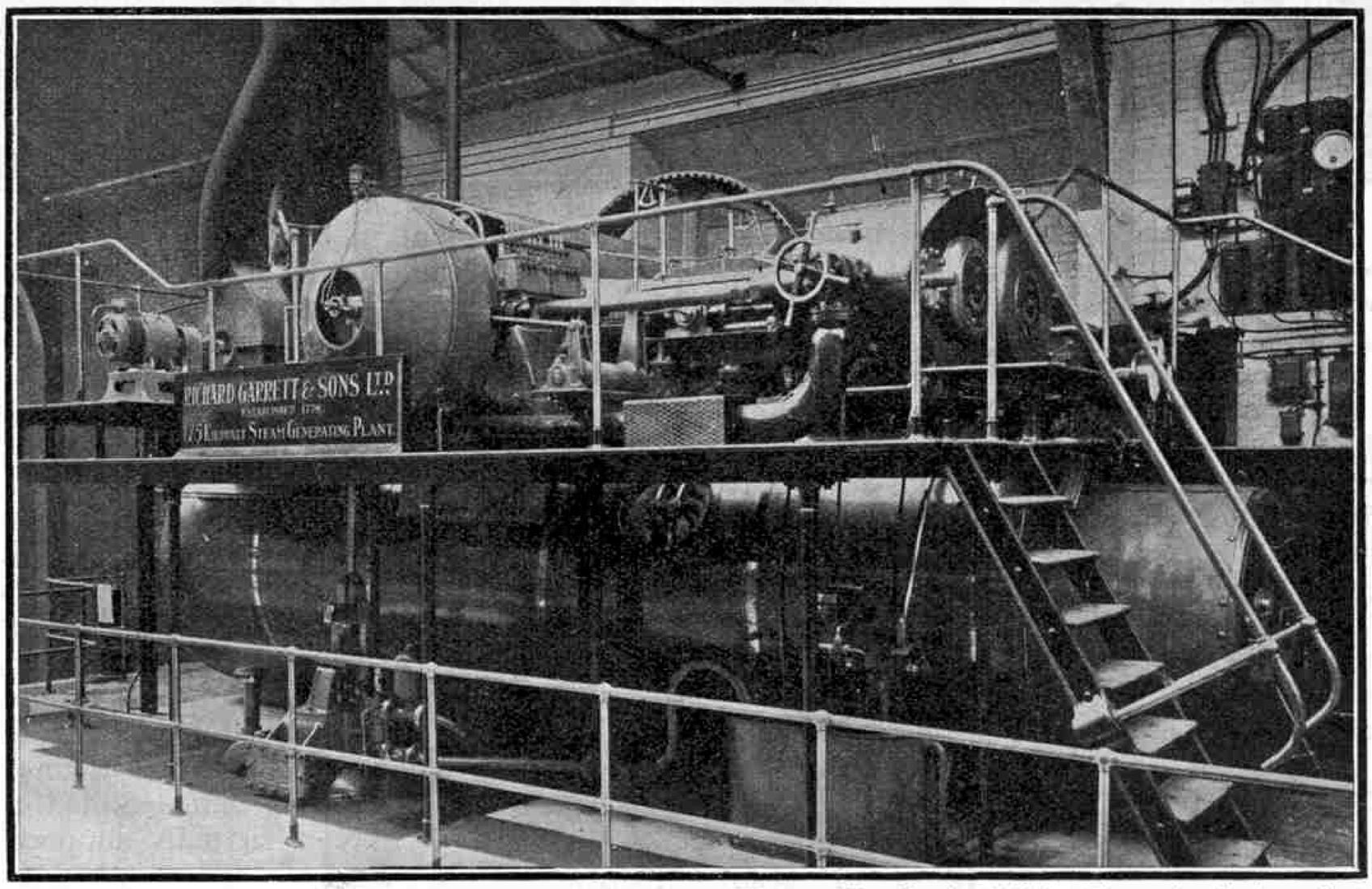
British Telescope for Canadian Observatory

A reflecting telescope that will be the second largest instrument of this type in the world is now being made at Newcastle-on-Tyne by Sir Howard Grubb, Parsons & Company. Its concave mirror will weigh 5,000 lb. and is now being ground and polished from a disc of glass 76 in. in diameter and 12 in. in thickness. The aperture of the telescope will be 74 in. in diameter and it is expected that it will be completed next year. The instrument is to be installed in an observatory now being constructed at Richmond, Ontario, for the University of Toronto.

The new observatory will be at a height of 800 ft. above sea level and will consist of two main buildings. One of these will be circular, with a diameter of 61 ft., and will house the great telescope. The second will be devoted to administration purposes, and will contain also laboratories, lecture rooms, libraries and a workshop, in addition to three domes that are to be equipped with smaller telescopes and other astronomical instruments.

At present the largest reflecting telescope in the world is that at Mt. Wilson, California, which has a mirror 100 in. in diameter. The next largest is the 72 in. reflector in the Dominion Observatory at Victoria, British Columbia. When the new telescope is completed, the 72 in. instrument will become the world's third largest, and Canada will have the dinstinction of possessing two of the three largest telescopes in existence. Plans are now in hand for an instrument with a mirror 200 in. in diameter, to be installed in a new observatory to be erected by the California Institute of Technology, and when completed this will dwarf all existing telescopes.

A further new telescope of exceptional interest is one of 40 in. diameter, specially designed on new principles for photographic work, that is being built for the United States Naval Observatory, Washington.



Semi-stationary steam power plant installed at the British Empire Exhibition at Wembley in 1924-5. The engine develops about 300 B.H.P. and, direct coupled to a suitable dynamo, was used as an auxiliary plant for providing electric current for the lighting of the Exhibition. The plant was built by Richard Garrett & Son Ltd., Leiston, to whom we are indebted for this illustration.

Tunnelling Under the River Scheldt

Two tunnels are now being constructed under the River Scheldt to connect the centre of Antwerp with St. Anne, on the opposite shore. One of these tunnels, which will cost about £2,500,000, will be used for vehicular traffic only, and 2,000 vehicles will be able to pass through it in an hour. The second tunnel, for the use of pedestrians and cyclists, will cost £500,000. It is designed to allow the passage of 16,000 persons an hour, and is provided with lifts and escalators.

A Modern Fire-Fighting Vessel

The "*John J. Harvey*," a modern fire-fighting craft recently built for service on the waterways of New York, is believed to be the most powerful and efficient vessel of this kind in the world. It is of shallow draft and thus is able to navigate the numerous creeks and to pass under all the bridges in the neighbourhood. No woodwork has been incorporated in its structure, all the rails, furniture and fittings being of metal. In addition, a screen of water may be thrown up by a large number of nozzles in order to prevent damage from fire.

The chief fire-fighting equipment of the vessel consists of two large monitor nozzles, each capable of delivering 3,000 gallons of water per minute, and six similar miniature nozzles, each having a capacity of 2,000 gallons per minute. Twenty-four hose outlets also are provided. The chemical extinguisher carried is capable of generating 500 gallons of foam per minute.

The "*John J. Harvey*" is 130 ft. in length, 28 ft. in breadth and 12 ft. 9 in. in moulded depth. The draft is 8 ft. 6 in. and the hull is reinforced with plating at the bow in order to enable it to break through ice.

Five eight-cylinder internal combustion engines, each of which develops 548 h.p. at 1,150 r.p.m., form the propelling and pumping units. When the vessel has reached the scene of operations, one engine gives sufficient power to keep it in position, and the remaining four engines may be employed to drive the powerful pumps.

World's Largest Oil Pipeline

Work on the oil pipeline from Kirkuk, in Iraq, to the Mediterranean coast, referred to on page 505 of the "*M.M.*" for July, 1932, was started in September last. The line is being laid by British, American and French interests, and is 1,200 miles in length, thus being the longest in the world. Its terminal point on the Mediterranean seaboard is at Haifa, where there is a large new harbour; and a branch line will be carried to El Mina, the sea outlet of Tripoli, in the Lebanon. It is believed that the completion of the pipeline will greatly increase the importance of these towns, and large areas of land near them are being set aside for the provision of storage accommodation and for the eventual construction of receiving and refining plants.

Many hundreds of lorries and cars have been requisitioned to serve as a transport fleet during the construction of the line. Materials and supplies will have to be carried across the Rivers Tigris and Euphrates, and for this purpose what are known as "Blondin" ferries will be employed. These consist of thick cables stretched between towers on opposite banks, goods being swung across the waterway on the cables.

In the Jordan Valley the pipeline will be 850 ft. below sea level, and it will cross the mountain plateau of Transjordania at an altitude of 2,300 ft. Pumping stations to maintain the pressure of the oil will be constructed at intervals throughout its length. It is thought that 14 or 15 of these stations will be necessary, and about six will be on the British section of the line, which will be about 470 miles in length. Eventually a railway connecting Baghdad and Haifa may be constructed along the route followed by the pipeline.

A modern multiple plough hauled by a large motor tractor. It is capable of doing six times the work of an ordinary horse plough.

Motor with Shaft Two Feet in Diameter

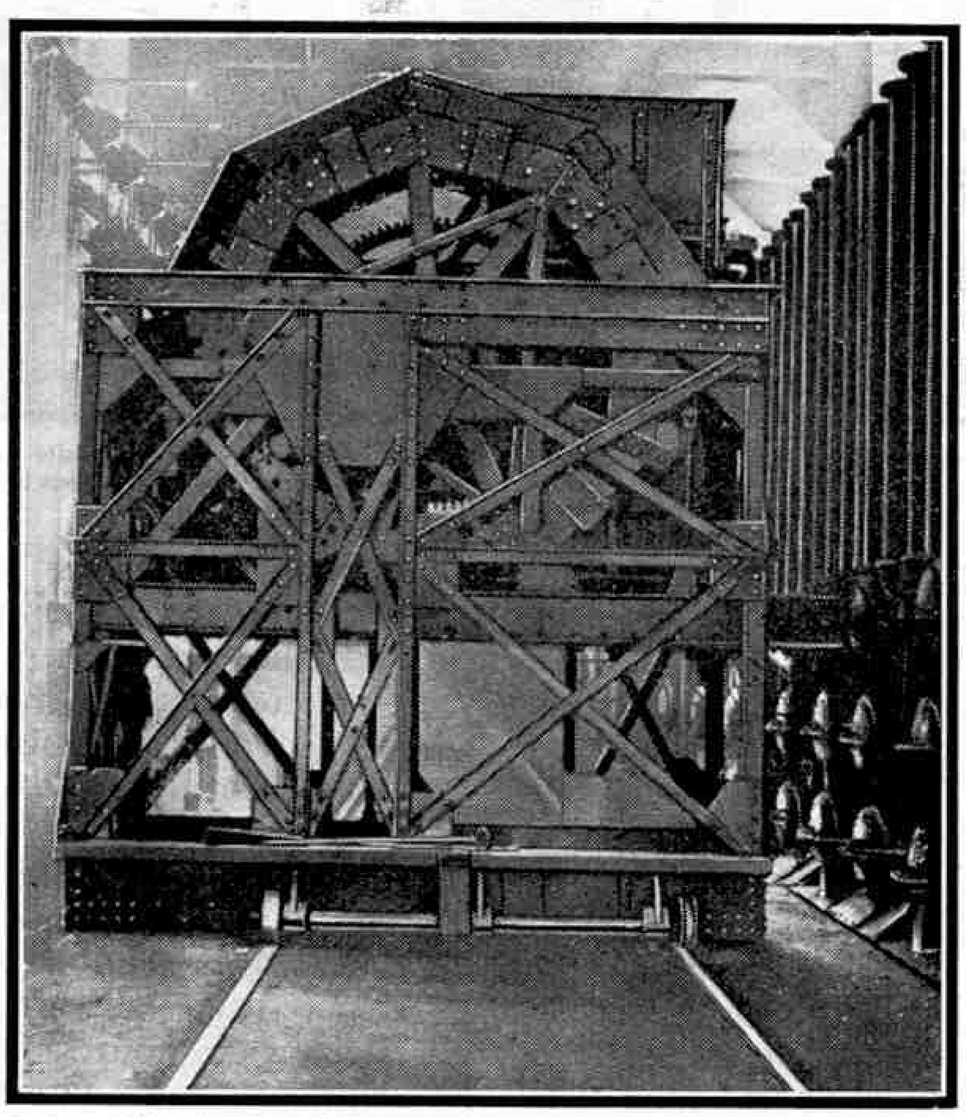
A synchronous motor that is claimed to be the largest of its kind ever built in Great Britain is now under construction at the Rugby works of the British Thomson-Houston Co. Ltd. It is intended to drive a continuous sheet bar and billet rolling machine at the Jamshedpur Works, India, of the Tata Iron and Steel Co. Ltd., and the British Thomson-Houston Company are also supplying automatic control gear for starting, reversing and emergency stopping.

The motor has a diameter of 20 ft. and its shaft is 2 ft. in diameter. It is of the totally enclosed type, and is provided with closed-circuit air cooling. Current at 6,300 v. will be required to drive it, and normally it will develop 7,500 h.p. at 93.8 r.p.m., but it will be capable of taking peak loads of 18,750 h.p.

It is interesting to note that within 24 hours of the receipt of the order the stator plates of the motor were being flame-cut in the works at Rugby as a preliminary to the building-up of the frame.

Largest Boilers in Great Britain

Three boilers that are claimed to be the largest yet constructed in Great Britain have been installed at the newly-completed Ironbridge Power Station, in the West Midlands. Each has a total heating surface of 33,250 sq. ft. and is capable of converting 225,000 lb. of water into steam per hour. When necessary this rate may be increased to 270,000 lb. per hour. The steam pressure is 400 lb. per sq. in. and its working temperature 800°F., and the boilers will be fired by means of pulverised coal, a light grade of oil being supplied through auxiliary burners for use when the boilers are being lighted-up.



A Retort Charging Machine at a modern gasworks. The machine travels along a wide track in front of the retorts. The coal for the charges is drawn from overhead hoppers and passes down an enclosed chute into the conveyor of the machine, from which it is fed into each retort.

The turbine makes 1,500 revolutions per minute. It is of the two-cylinder double-flow type and is provided with impulse blading of stainless steel throughout. The stator of the alternator weighs 110 tons, and was built up on the site it occupies, because it was too large for transport. It is wound for 9,500 v. with two separate parallel windings.

The Institute of Marine Engineers

The Council of the Institute of Marine Engineers desire to remind young engineer apprentices and students of the educational advantages afforded by association with the Institute. Apprentices and other young marine engineers may join the Institute as student members. Admission is by examination, and students must be under 25 years of age. They must have completed at least one year of attendance at day or evening classes, as a part of a regular course in engineering or naval architecture, at an approved educational institution, and have attained an examination standard prescribed by the Institute.

Arrangements are now being made for the next annual examination, which will be held in April, 1933, at various centres, according to the candidates' places of residence. Full particulars and copies of previous examination papers may be obtained on application to the Secretary, The Institution of Marine Engineers, The Minories, London, E.C.3, on mention of the "*Meccano Magazine*."

Welded Floors of Giant American Hangar

The new giant airship hangar, 1,200 ft. in length, now being constructed at Sunnyvale, California, in order to accommodate United States Navy airships, was described on page 751 of the "*M.M.*" for October, 1932. It is claimed that this will be the largest building yet erected in which no pillars or posts are employed to support the roof, and will have the world's largest unobstructed floor area, its 300,000 sq. ft. of surface being sufficient to accommodate railway sidings with a total length of five miles.

On each side of the hangar there will be a sheet-steel battle-deck mezzanine floor running the entire length of the building. Each of these floors will consist of steel plates 12 ft. in length, 2 ft. in width and 3/16 in. in thickness. The plates will be welded together, and the joints are to be ground flush with the surface after the welds are completed. The I-beams and splice plates beneath the floor also will be welded, and a special travelling scaffold, itself of welded pipe construction, has been built to enable this work to be carried out.

New Bridge Across the Nile

A new bridge has recently been constructed over the Nile at Edfina by The Cleveland Bridge & Engineering Co. Ltd., of Darlington. The bridge has been built to carry an extension of a branch railway from Alexandria to Edfina and Sidi Ghazi, and it supplements another bridge near by, known as the Dessuk Bridge.

The new bridge has an overall length of 984 ft. and is made up of four spans. Three of these are fixed and are 261 ft. 6 in. between centres of bearings, and there is a swing span that measures 180 ft. between the centres of wedge bearings.

"Getting Ready For Sea"

Manœuvres in the Engine-Room

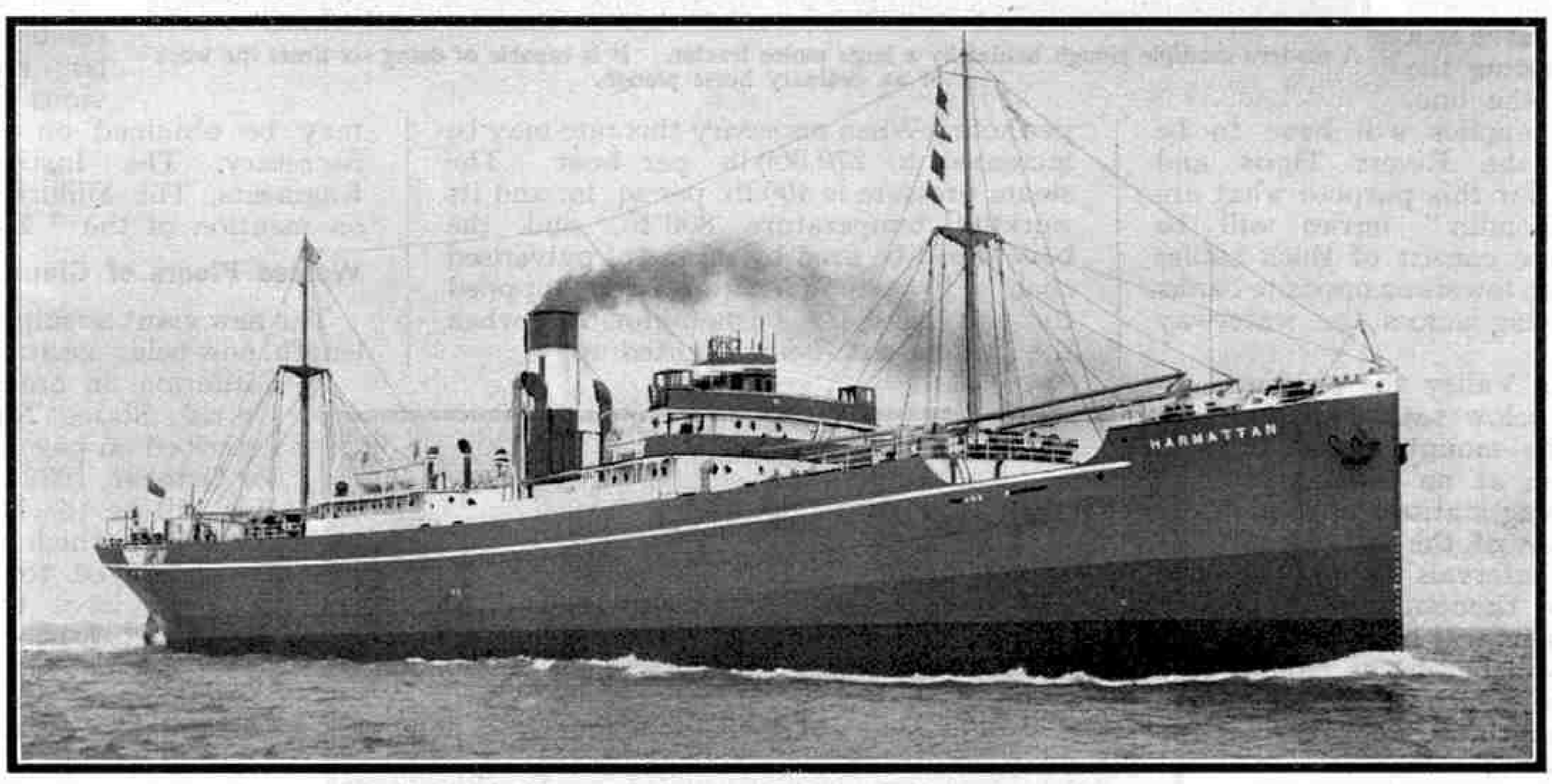
By "Fourth Engineer"

THE ship is almost down to her marks with cargo, and the mate is superintending the final preparations for securing the hatches. At that moment the steward makes his way aft to the engineers' quarters. He reaches the mess-room at the same time as the Third and Fourth engineers, who are drifting in for dinner.

"Is the Chief in?" queries the steward. The mess-room boy nods his head, as mess-room boys will do, being very economical where speech is concerned.

"Give him the 'Old Man's' compliments and ask him if he will go along to the cabin," says the steward, and departs.

The Third and Fourth look at each other glumly. They know that the "Old Man's" request for the Chief's presence means that the spell in port is finished, and that the ship will sail either that evening or the following morning. The return of the Chief a few minutes afterwards confirms their impressions.



S.S. "Harmattan," a vessel fitted with engines and boilers similar to those shown on the opposite page. She is 395 ft. in length and 54½ ft. in breadth, with a gross tonnage of 5,000. For permission to reproduce the illustrations to this article we are indebted to The North Eastern Marine Engineering Co. Ltd.

At that moment the Second arrives in the mess-room, and is immediately informed that watch-keeping will commence at eight p.m. That means that day-work—7 a.m. until 5 p.m.—will cease at once, so that the firemen need not "turn to" at two bells, 1 p.m. Their orders are to sail at eight o'clock on the following morning.

The Third ceases work at the dinner-hour, as he will have to turn out at midnight to keep the 12 to 4 watch. The Second and Fourth engineers now commence the business of "getting her ready." The Fourth informs the men forward that watch-keeping will commence at the time stated, and at the same time instructs the donkey-man to "coal the bars" preparatory to raising steam.

On completion of these instructions the Fourth proceeds to the engine-room in order to start the pumps at the task of filling the boilers. This, it must be borne in mind, is only done when the ship is in a fresh-water river. In cases where the ship is berthed at a salt-water quay, fresh water is obtained from ashore, as the salt water is too dense for boiler purposes. The pump is stopped on completion of the boiler-filling operation, and the Fourth then directs his energies to pumping the bilges, in this case using the ballast pump.

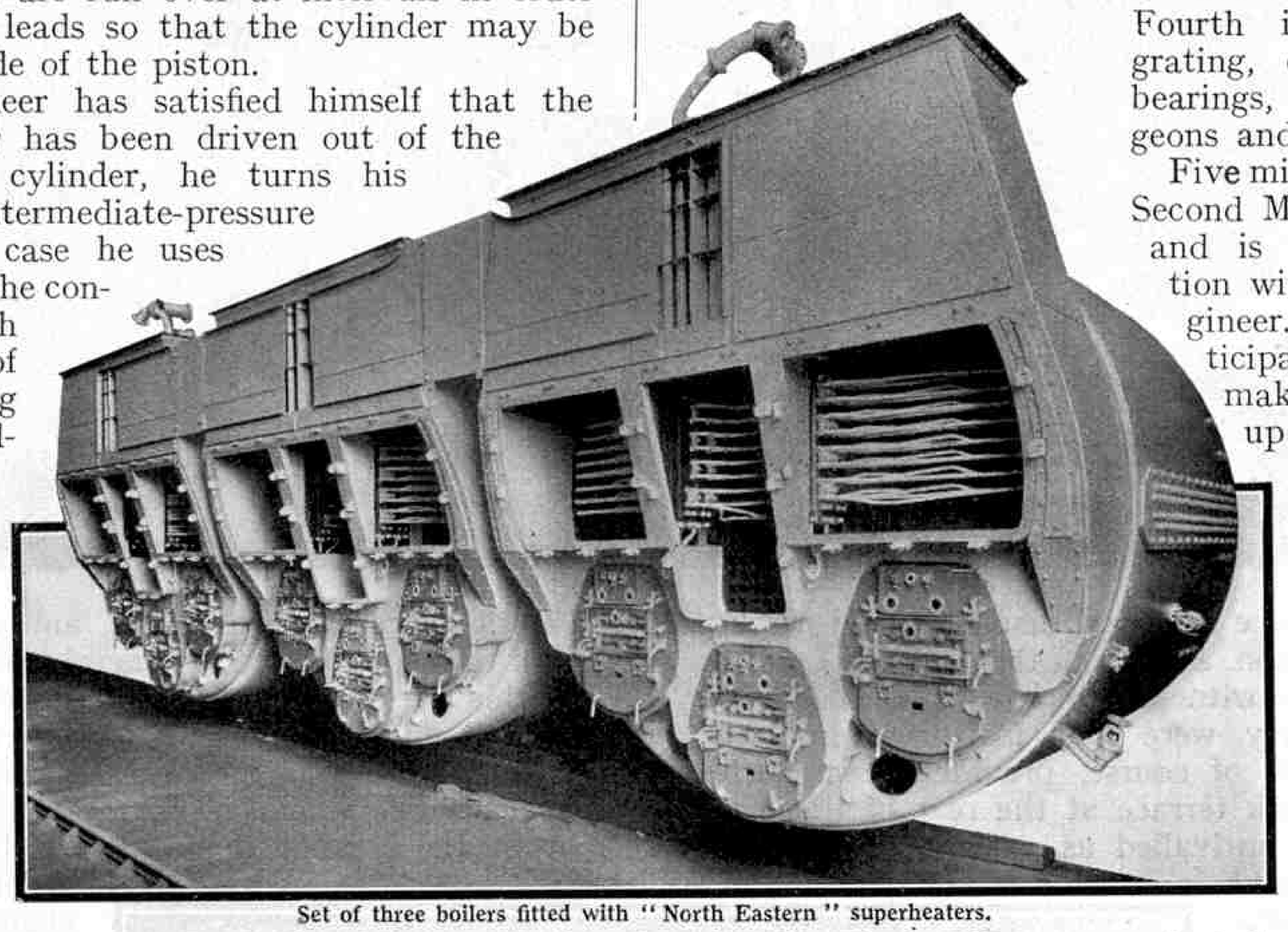
In the meantime the donkey-man is gently "shaking the fires," and the Second is running the link-reversing engine in order to ensure that, when the occasion arises for "Full Astern," the gear shall not be found wanting in easy running. The need for this will be more fully appreciated when it is understood that in working a ship into or out of port the telegraph is almost constantly ringing. No sooner does the bell ring to "Slow Ahead" than it is changed to "Full Astern"; and when the link-reversing gear sticks, the Second's hair almost turns grey during his frantic effort to free it. By this time the water in the boiler is appreciably warm, and the next operation is "circulating the boiler." This consists of drawing the water from the bottom of the boiler and discharging it at the top, and is continued until the temperature of the water is uniform.

The Second and the Fourth at this stage feel that tea-time can't be far off, and their surmise is confirmed by the appearance of the mess-room boy with the news that tea is ready. At eight p.m. the firemen are instructed to "steam her easy" and raise steam at 20 lb. per hour. During these anchor watches the engineers and firemen enjoy a comparatively easy time. Perhaps once in the watch the Third on the 12 to 4 may have a bilge to pump; nothing more.

At 4 a.m. the Second takes his watch, when the business of "warming her through" commences. The supply of steam to the engine-room service pipes having been changed over from the donkey-boiler to the main boiler, the Second immediately gives the links a run over. Main cylinder drains are open to lead to the atmosphere, and steam is admitted to the high-pressure cylinder. Great care is taken to

admit only sufficient steam to warm the cylinder portion open to the inlet steam port. During this operation the links are run over at intervals in order to alter the valve leads so that the cylinder may be warmed on each side of the piston.

When the engineer has satisfied himself that the last drop of water has been driven out of the steam chest and cylinder, he turns his attention to the intermediate-pressure cylinder. In this case he uses the impulse valve, the construction of which is in the form of a steam-chest having two ports, one leading direct to the intermediate-pressure steam chest, and the other to the low-pressure chest. It is usually situated on the intermediate-pressure cylinder column, just below the intermediate-pressure cylinder, and is controlled by a rod attached to a lever conveniently placed within reach of the engineer. The operation of warming is repeated in the case of the low-pressure and the intermediate-pressure cylinders, and now everything is ready for a final try-out. The impulse valve is closed and the engine stop-valve opened wider than when warming the high-pressure cylinder. The Second, though convinced that all water is driven out, cannot conceal the sigh of relief he gives when the huge cranks successfully make one complete revolution.



Set of three boilers fitted with "North Eastern" superheaters.

The engine-room clock points to six a.m., time to call the Fourth. Ten minutes later the Fourth appears, sleepy but cheerful. "Good morning Second," he greets. "Everything all right?"

"Aye," replies the Second. "Take a spanner down the tunnel and ease the stern gland."

The Fourth disappears down the tunnel, and emerges a few minutes later in time to greet the Second Mate.

"Steam on deck, Fourth, please," requests the Mate.

"Fore or aft?" enquires the Fourth.

"Both," replies the Mate.

"Righto," and the Fourth again disappears on to the boiler-tops. A minute later he is seen descending through a trap below the engine platform in order to ascertain the amount of water in the starboard bilge. On ascending, he disappears round by the condenser, and ten seconds later the pump is heard. Afterwards the Fourth is found on the grating, oiling the various bearings, pump-rods, gudgeons and link gear.

Five minutes afterward the Second Mate again appears, and is seen in conversation with the Second Engineer. The Fourth, anticipating the order, is making his way slowly up the steps. "Steam on the steering-gear," the Second bawls out.

The Fourth proceeds to carry out the order, and having adjusted the reducing valve that supplies steam to the steering-engine, he meets the Second Mate emerging from the recess that houses the steering-engine.

"You can close the deck steam valves, Fourth," says the Mate.

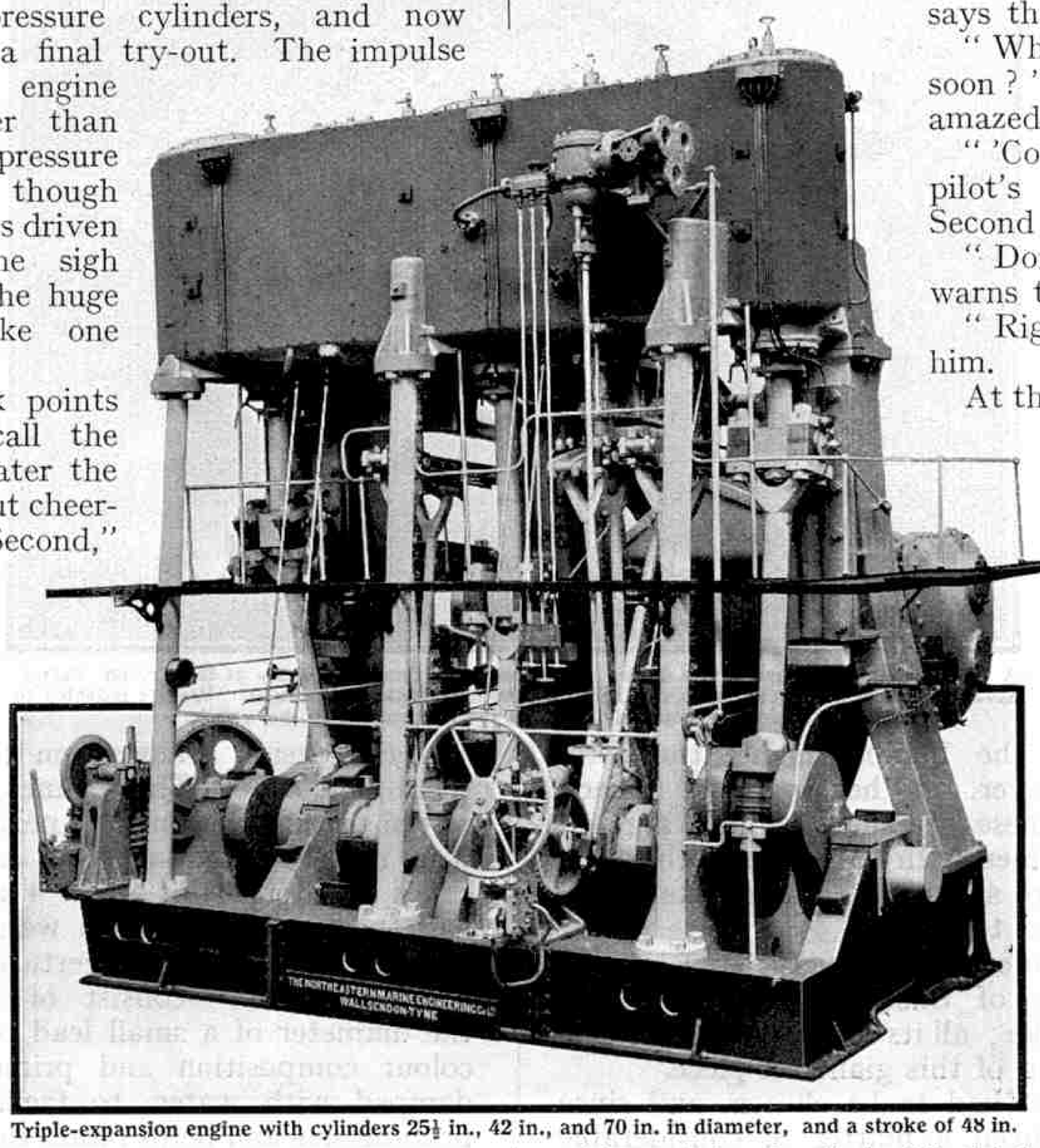
"Why, have you finished so soon?" queries the Fourth, amazed.

"'Course we've finished; the pilot's aboard," replies the Second Mate.

"Don't forget the letters," warns the Fourth.

"Righto," the Mate assures him.

At that moment the telegraph bell clangs to "Slow Ahead." The Fourth dashes below to take his stand at the telegraph. A minute later "Half Astern" rings—then "Half Ahead." Ten minutes later comes "Stop," which means dropping the pilot. Another minute, and the telegraph swings, almost aggressively, to "Full Ahead."



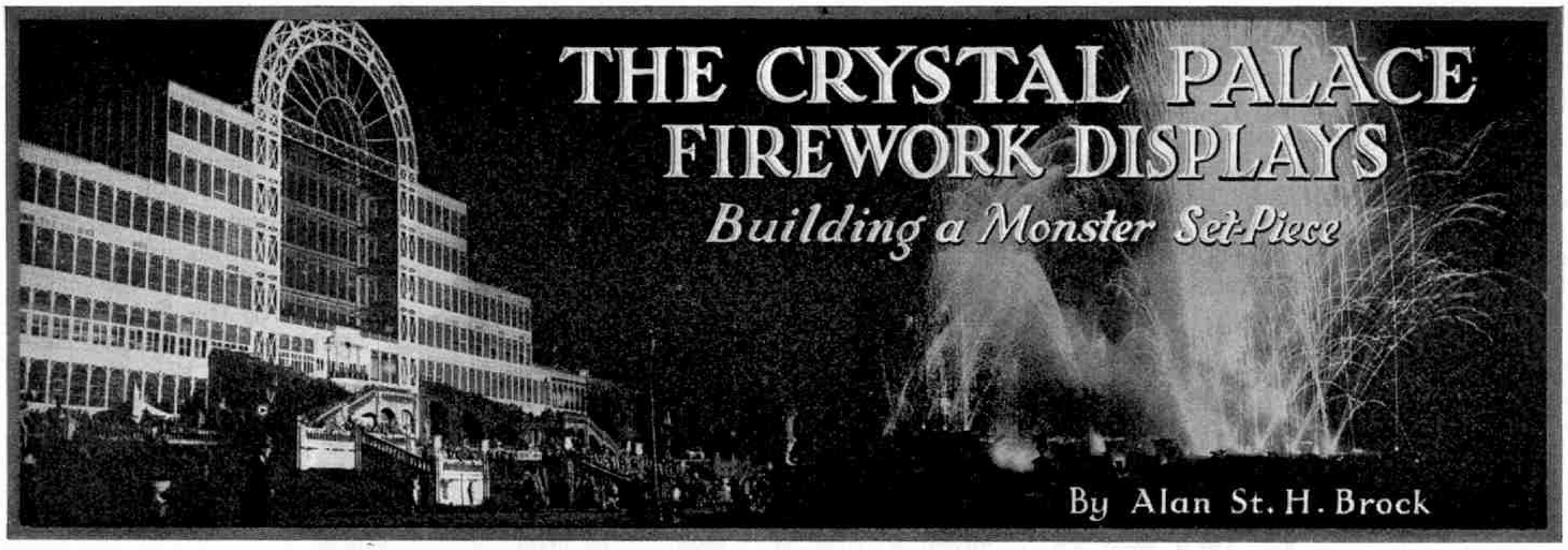
Triple-expansion engine with cylinders 25½ in., 42 in., and 70 in. in diameter, and a stroke of 48 in.

The Second Engineer gives a final glance round—everything is running smoothly.

"Well," he remarks, with a sigh of relief, "I think I can manage a bit of breakfast, Fourth."

"Yes," replies the Fourth, "so can I. Tell the Third not to take a week over it."

The Second merely grins in reply.



THE Crystal Palace firework displays, held weekly during the season, are one of the sights of London, and have been witnessed by well over 10,000,000 spectators since they were first instituted in 1865. The Palace grounds, of course, provide a wonderful setting. The firework terrace at the rear of the main Palace buildings is unrivalled as a firing ground, but the huge building and the remarkable fountains all demand effects on a correspondingly grand scale.

The programme on these Thursday evenings includes over 40 items, but the most popular and the most fascinating of all is the immense pictorial set-piece originally introduced in 1875. The first of these set-pieces was about 40 ft. long, but this year the picture shown is 600 ft. in length, and in places 80 ft. in height. The subject chosen is the bombardment of the Woo Sung Forts, Shanghai, by Japanese cruisers and destroyers. Briefly, this is what happens. In reply to the bombardment, the forts sink a Japanese destroyer. A heavy aerial attack is carried out by Japanese seaplanes, which are engaged by Chinese machines with losses to both sides. The guns of the forts are silenced and the forts themselves eventually reduced to ruins.

A remarkable photograph taken during the course of a firework display at the Crystal Palace. Several types of set-piece frames can be seen silhouetted against the light. We are indebted to C. T. Brock & Company Ltd., for the illustrations to this article.

How is it done? Readers will already have learned from the October issue of this magazine what our factory at Sutton looks like; all its resources are brought into play for the building of this giant set-piece.

First of all the subject had to be chosen, and since the Great War it has been a matter of considerable difficulty to find a topical battle, or indeed to discover centenaries of great fights for reproduction. The period between the Battle of Waterloo and the Crimean War is, singularly enough, almost devoid of noteworthy engagements. The subject once decided upon, an outline drawing was made, and when the immense size of the reproduction is remembered, it will be realised that this was a matter that entailed considerable labour. After all unnecessary lines had been eliminated from this drawing it was then ruled in squares of such size that each one would represent an area of one square foot in the completed piece when built up.

The scene then changed from the drawing office to the drawing floor. This is situated in a big building and resembles very much the "moulding loft" in a shipyard where the various frames of a ship are reproduced in wood to the actual size required. The floor is about 200 ft. in length, and on it were laid frames consisting of light battens forming foot squares and of a convenient size for handling, generally 10 ft. by 5 ft. The top illustration on the next page gives a good idea of the operations at this stage.

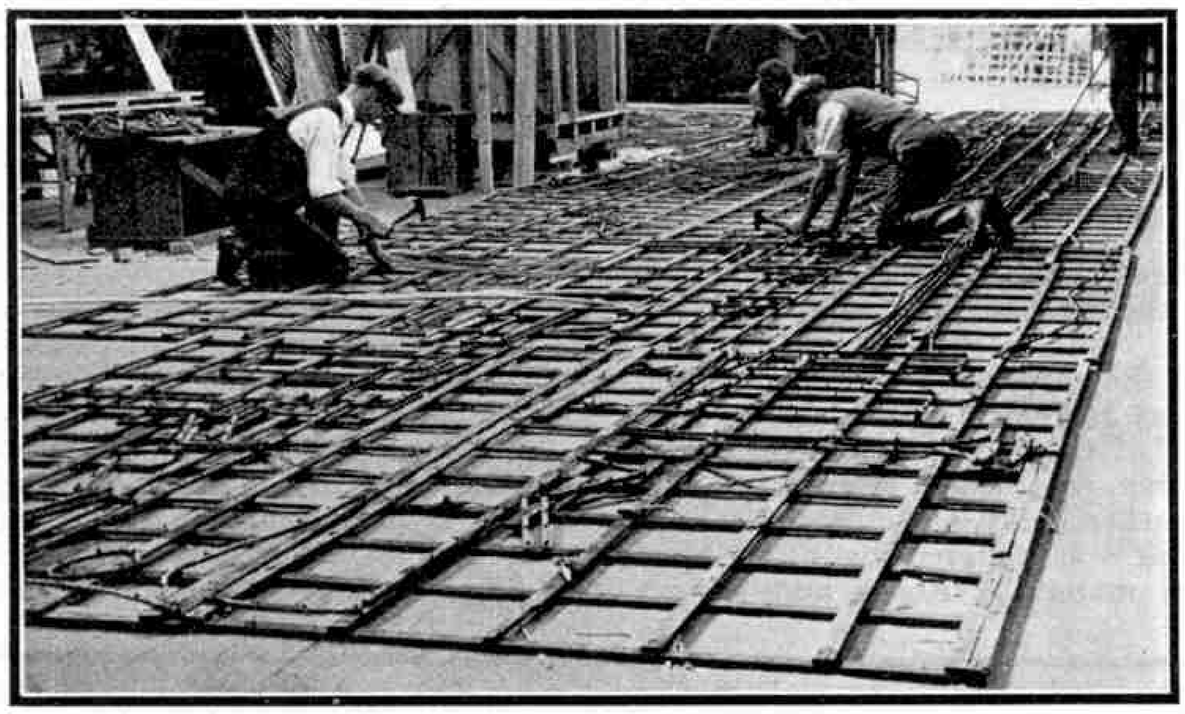
The drawing was then transferred to the floor, and the design followed on the frames by nailing to them thin cane. These canes, which show the outline of the picture were next "pegged," that is to say small wire nails pointed at each end were driven into the canes at intervals of about 4 in. After that, "lances" had their ends glued and were pushed on to the pegs, so that they stood up vertically from the framework. These "lances" consist of thin paper cases about the diameter of a small lead pencil, and are filled with colour composition and primed with mealed powder damped with water, to facilitate the lighting. This priming sets and helps retain the contents of the "lance," which are not so tightly compressed as in the case of fountains, rockets, etc. Quick-match, connecting these "lances," was secured by pins driven into the priming. The match was pierced above the priming and secured and protected by a strip of paper pasted

over it and round the case of the "lance."

Each frame, as I have said, is 10 ft. by 5 ft., and it may be an interesting arithmetical exercise to find out the total number of frames used in this particular set-piece, which is 600 ft. long and in places 70 or 80 ft. high!

The picture was now complete, but it was in some hundreds of sections, each of which was numbered according to its position in the picture.

Look now at the lower illustration on this page that shows the terrace at the Palace. You will there see the immense poles and girders on which these frames are being hoisted, and it is quite easy to distinguish the cane that traces the design, the "lances" standing out horizontally, and the quick-match forming the continuous line on the outside.



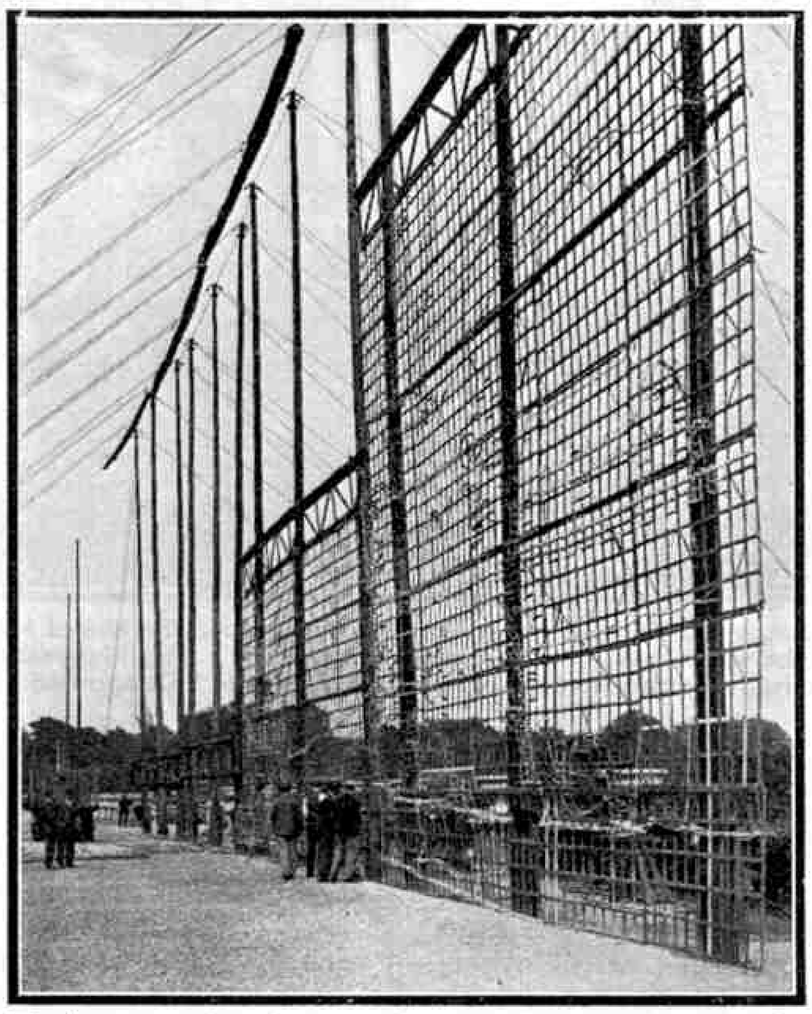
A scene on the drawing floor at the Brock factory during the laying out of a set-piece. Note particularly the cane with which the outline of the picture is traced.

This work of placing in position is done during the day of the display. On the following day the frames are taken down and returned by lorry to the workshop, and the work of fitting up the set-piece goes on in preparation for the following week.

It may be of interest to know that, for the construction of the battle of the Woo Sung Forts, half a million feet run of wood battens were used, and some 40,000 lances had to be placed in position; four miles of quick-match linked up the lances. Hundreds of pounds of various kinds of explosive material were dotted here and there over the frames to provide the detonation of the shells, the exploding of bombs, the blowing up of ships and the burning of buildings and vessels.

Our arrangements, after such long experience, are pretty well fool-proof, but we have to be prepared for any emergency. A case in point occurred early during the present season. Twenty thousand people were watching the display, and none of them knew that the set-piece had been prematurely ignited. They just saw that it was not in its usual place in the programme. One of the earlier items of the display is a flight of fiery pigeons. Now one of the pigeons, apparently, flew too fast and furiously, and finished up by trying to nest in the set-piece, which it at once set alight in one section. The set-piece only burns for about a couple of minutes, but fortunately the 20 men who light it in different places were all available and they rushed off to their firing points. Within a quarter of a minute we had the whole going merrily, just as usual.

We pride ourselves on our efficiency and on the fact that, wet or fine, we put up a really good show. But once we were unable to extricate ourselves so successfully as usual. Rain has little effect on the set-piece or ground-pieces provided that it is not too heavy. Last season, however, one Thursday had brought pelting rain, a continuous heavy downpour; and a couple of hours before the show was timed to begin I realised that the set-piece would be useless. Still, nothing daunted, we rushed up a lorry-load of big shells and rockets from Sutton, intending to give an unusually complete aerial display. But we had not accounted for everything. The clouds were so low that all this big stuff exploded on the farther side and nothing could be seen! The lesson, I may say, has been learned, and we have taken steps to avoid trouble from this quarter in future.



The immense size of the set-piece described in this article is well shown in this photograph, which was taken during the course of erection on the firework terrace at the Crystal Palace.

One of the most interesting series of experiences that have fallen to members of my firm during their long association with the Crystal Palace, has been the opportunity afforded for meeting a large number of royal personages. There are very few crowned heads who have not seen the Crystal Palace displays at least once, and their numbers include their present Majesties the King and Queen. The ex-Kaiser during his visit congratulated my father on the display, observing, however, that the Palace was not the only place where such an excellent show was given. He had seen one the previous week at Amsterdam, he said, which in many ways was quite equal to that evening's performance. We were able to explain to him that the Dutch display also was arranged by the firm of Brock! The late Sultan of Turkey was also a visitor, and he was so impressed by what he saw that, at his request, my uncle established a fireworks factory in his own kingdom.

Our royal visitors have included not merely heads of European states, but others from much farther afield. Amongst the more notable visitors were the Emperor of Abyssinia, King Cetewayo of the Zulus, the late Shah of Persia, and also, nearly 50 years ago, the King of the Maoris. His Majesty, on seeing the vast crowd assembled beneath the royal box, remarked that he did not know there were so many people in the world.

Probably the greatest display ever given was the Peace Display that signalled the conclusion of the Great War and took place in Hyde Park in 1919. Their Majesties the King and Queen, and members of the royal family viewed the display from a special platform erected on the roof of Buckingham Palace. It is believed that more people saw this show than had seen any one entertainment anywhere in the world before.

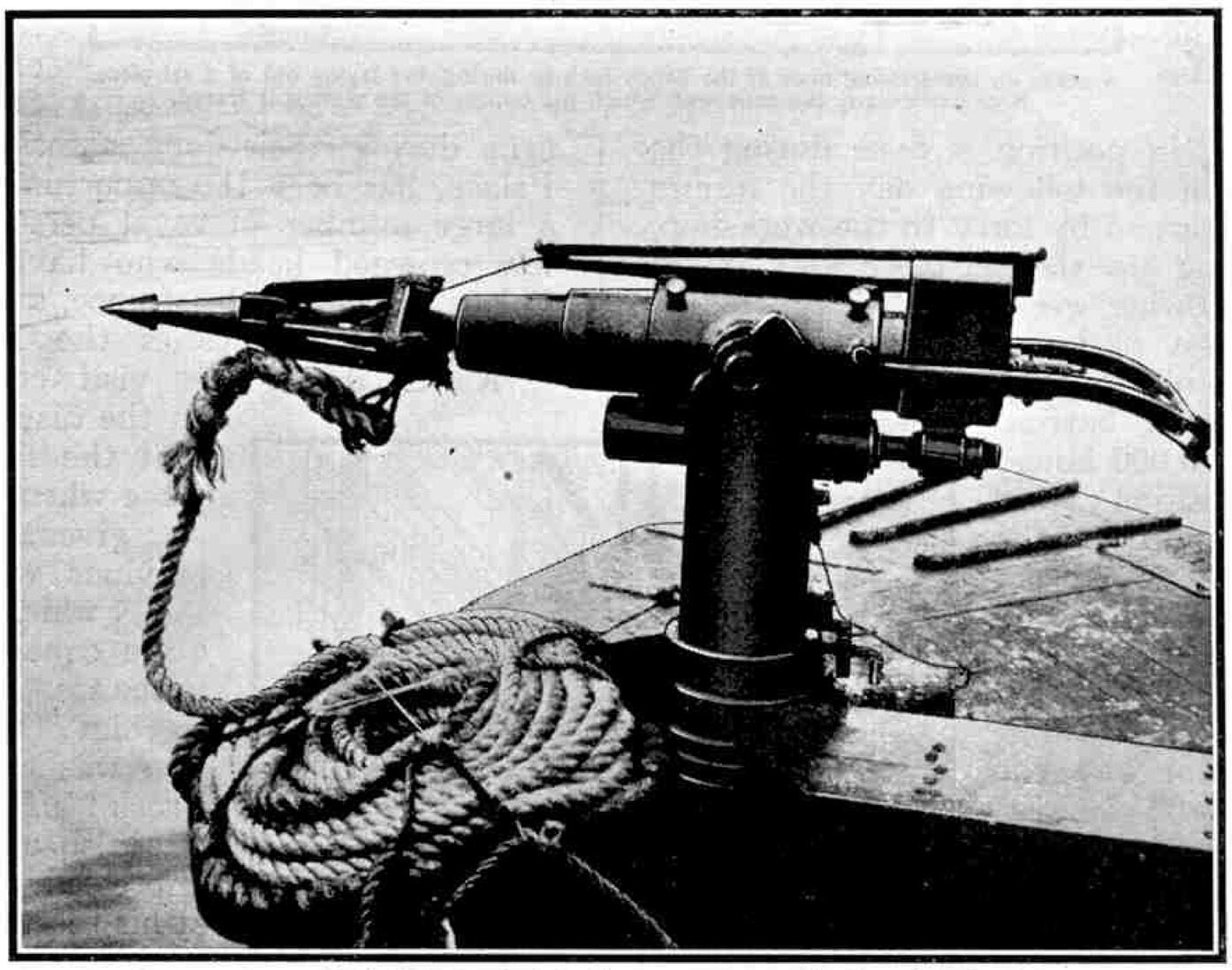
The Romance of Whaling

III.—The South Sea Whalers of a Century Ago

THE gradual movement of the whaling industry from the Arctic to the southern seas, as described last month, necessitated increasingly longer voyages by the British and other northern whalers, and voyages lasting two or three years became general. The whaling ships engaged on these long voyages were entirely self-contained, so that the whales that were captured could be dealt with on the spot.

The south sea whaling ship of the early 19th century differed in several respects from an ordinary merchant sailing ship of that time. For instance, about 10 ft. of the bulwark amidships was constructed so that it could be removed easily to facilitate the hoisting aboard of the head and other bulky portions of the captured whale. Here also the deck was covered by a platform for the reception of the hoisted material. Ropes and pulleys were attached to the head of the mainmast for lifting the thick sheets of blubber as these were cut from the dead whale moored alongside the ship, and short spars were attached to the side of the ship to prevent the hull from being scraped by the heavy blubber while this was being hoisted up to the deck.

The outstanding feature of a south sea whaling ship of this period, however, was the peculiar flat-topped structure that extended across the deck amidships, and was known as the "try works." It was built of brick, and usually was about 9 ft. or 10 ft. square, and about half as high. Inside the building were two simply-made furnaces each surmounted by a huge iron cauldron called a "try pot," which was large enough to hold 100 to 200 gallons of whale oil.



A modern harpoon gun. Behind the head of the harpoon are seen the hinged barbs that open when the harpoon has pierced the whale, and detonate a charge of powder. This illustration and the upper one on the opposite page are reproduced by courtesy of the Editor of "Compressed Air Magazine."

F. C. Bullen, in his well-known book "*The Cruise of the Cachalot*," gives the following description of the try works of this typical American whaling ship: "Square funnels of sheet-iron were loosely fitted to the flues, more as a protection against the oil boiling over into the fire than to carry away the smoke, of which from the peculiar nature of the fuel there was very little. At one side of the try works was a large wooden vessel, or hopper, to contain the raw blubber; at the other, a copper cistern or cooler of about 300 gallons capacity, into which the prepared oil was baled to cool off, preliminary to its being poured into the casks. Beneath the furnaces was a space as large as the whole area of the try works, about a foot deep, which, when the fires were lighted, was filled with water to prevent the deck from burning. . . . The fires were fed with scrap, or pieces of blubber from which the oil had been boiled, some of which had been reserved from the previous voyage." No other fuel was used on these 19th century whaling ships, for there was always an abundant supply of boiled blubber available.

In some whaling ships the oil was not ladled from the try pots, but passed to the cooler by way of a long spout. The try works was erected before a ship set out on her hunting expedition, and was dismantled as soon as a full cargo was obtained or whaling operations were abandoned. In the interior of the ship large iron tanks were situated between the decks for the storage of whale oil in bulk, while hundreds of casks were carried and filled with the oil. Until they were required for oil some of the casks were utilised for fresh water, and served as ballast.

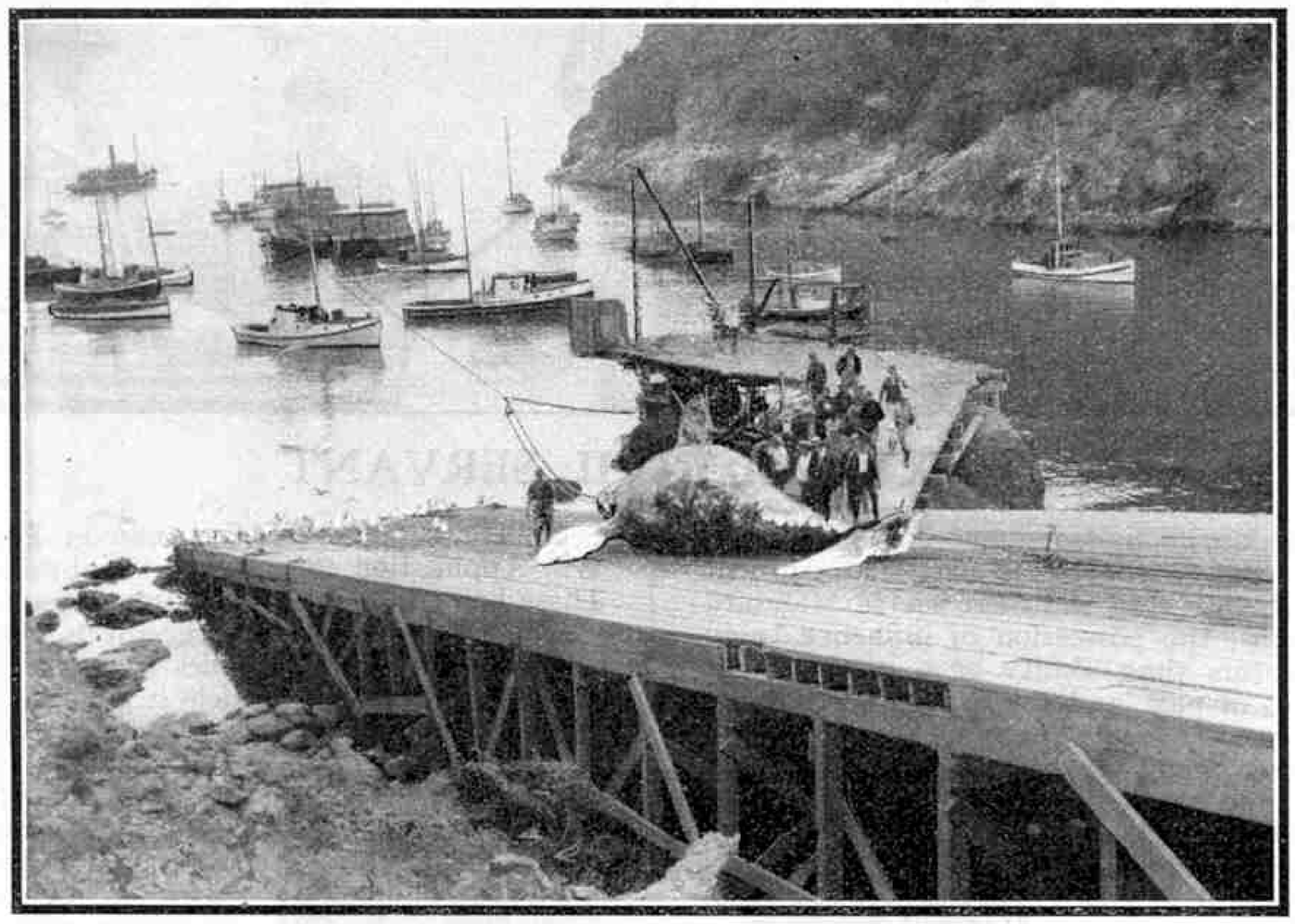
A British whaling ship that hunted in the south seas usually carried four boats, commanded by the mates of the ship; sometimes the captain commanded one of them. These boats differed from those of a merchant ship in being double-ended so that they could be rowed bow or stern first with equal ease, and in being steered by a long oar at the stern instead of by a rudder. The steering oar was used in preference to a rudder because speed is of great importance to a whaling boat, and the movement of a rudder to right or left has a dragging effect on the speed of a boat. A portable mast and sail were carried in each boat, and were rigged up immediately the craft set off in pursuit of a whale. The boats were about 28 ft. long and about 5 ft. wide, and were manned by a crew of five or six men consisting of the harpooner, the steersman, the linesman and three or four oarsmen, one of whom attended to the sail when this was set. The boats were large enough to hold about a dozen people, and thus when necessary could accommodate the crew of another boat wrecked during whaling operations.

Small platforms at the bow and stern, covered with boat mats, provided good foothold for the harpooner and the steersman respectively, while a "thigh-board" projecting from the inside of the bow steadied the harpooner as he stood ready to hurl his weapon. Usually three harpoons and as many lances were placed in the bow of the boat, and reserve supplies were stowed conveniently near. The harpoons generally used on the British whaling ships were arrow-shaped and were made of the finest wrought iron. They were about 3 ft. long, and were secured to heavy 5 ft. poles. The harpoons used on some of the American whaling ships were slightly different, and Bullen describes them as being shaped "rather like an arrow with one huge barb, the upper part of which curved out from the shaft. The whole of the barb turned on a stout pivot of steel, but was kept in line with the shaft by a tiny wooden peg which passed through barb and shaft, being then cut off smoothly on both sides. The point of the harpoon had at one side a wedge-shaped edge, ground to razor keenness, the other side was flat. The shaft, about 30 in. long, was of the best malleable iron, so soft that it would tie into a knot and straighten out again without fracture."

The harpoons were used merely to attach the boat to a whale, and very rarely inflicted a fatal wound, the lances being used for this purpose. The lances used by the American harpooners were, according to Bullen, "slender spears of malleable iron about 4 ft. long, with oval or heart-shaped points of fine steel about 2 in. broad, their edges kept keen as a surgeon's lancet. By means of a socket at the other end they were attached to neat handles, or 'lance-poles,' about as long again, the whole weapon being about 8 ft. in length, and furnished with a light line, or 'lance-warp,' for the purpose of drawing it back again when it had been darted

at a whale." The lance was then again thrust into the whale.

The harpoon line was one of the most important items of equipment and was of great strength, and the 200 fathoms of rope allotted to each boat was coiled carefully in a continuous line in two tubs stowed between the seats. Each end of the line was exposed, so that one end could be attached quickly and easily to the harpoon and, if necessary, the other end could be fastened swiftly to the line of a second boat, a spliced loop at the end of the rope being provided for this purpose. A stout post called the "loggerhead" was built into the aft end of the boat, and immediately a harpoon was launched the line was given several turns round this post, which thus took the strain as the line was paid out.



Captured whales are not all dealt with at sea, and this photograph shows a whale about to be hauled up an inclined platform to a whaling factory, at Trinidad.

Bullen, in the book from which we have already quoted, gives a thrilling account of the hunting of a large sperm whale. The lookout man of the "*Cachalot*" sighted the whale seven miles away, and the ship's four boats were quickly launched and manned by the picked crews. Sail was hoisted in a few moments, and aided by a strong favourable breeze the boats made good headway. The whale went below before the whalers could get near enough to strike, and they patiently awaited his return to the surface.

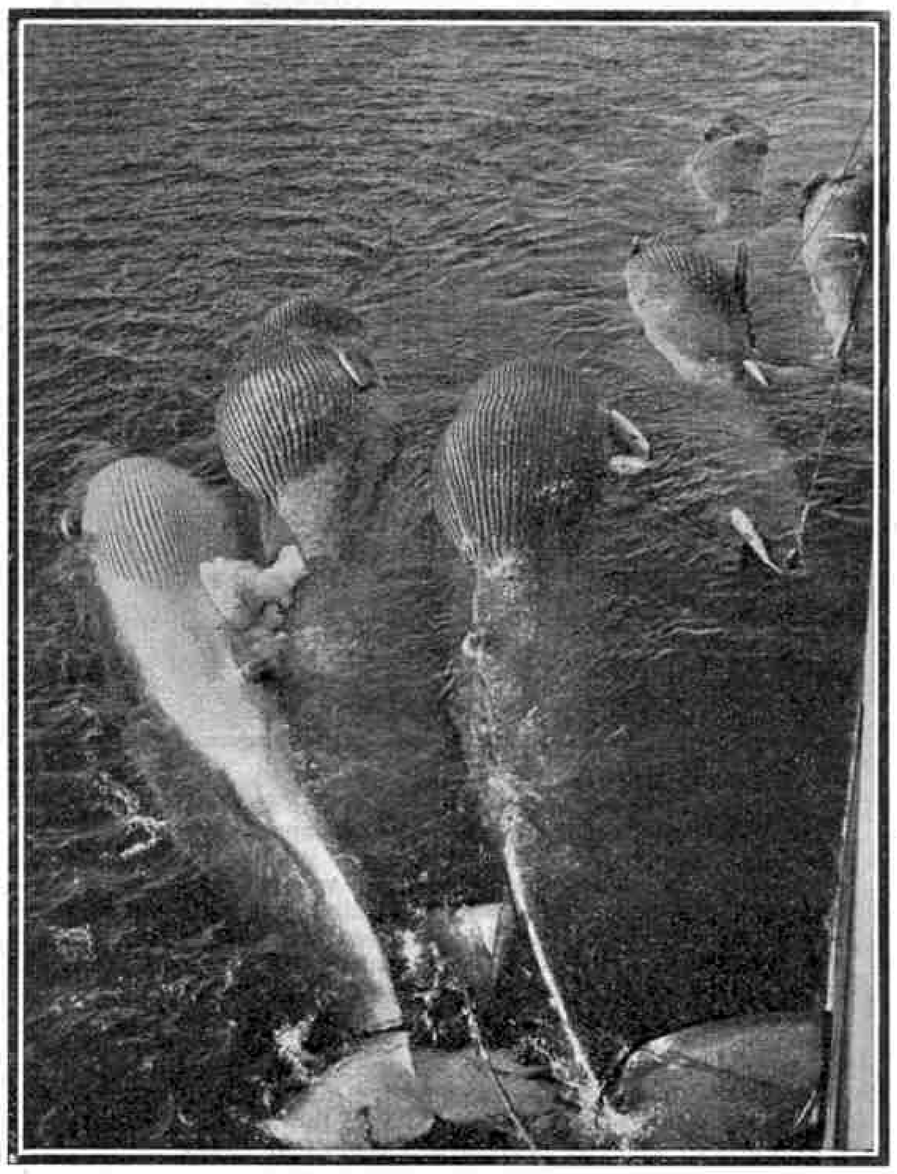
Bullen was in the first mate's boat. Suddenly the whale reappeared a short distance ahead, and when the boat drew close enough the harpooner plunged two harpoons in quick succession into the whale. The wounded animal rolled completely over several times backward and forward, and at the same time smote the sea with his mighty tail. Eventually he tired of endeavouring to free himself and went below again. On coming to the surface he set off to windward at a great rate, with the first mate's boat hardly 100 fathoms of line distant behind him. The chase was long and stern, but slowly the boat gained upon the whale, and the mate, whose excitement was intense, plunged his lance into the great black body, withdrawing it quickly and repeating the thrust at every opportunity.

"Suddenly the mate gave a howl: 'Starn all—starn all! oh, starn!' and the oars bent like canes as we obeyed," relates Bullen. "There was an upheaval of the sea just ahead; then slowly, majestically, the vast body of our foe rose into the air. Up, up it went, while my heart stood still, until the whole of that immense creature hung on high, apparently motionless, and then fell—a hundred tons of solid flesh—back into the sea. . . . Blinded by the flying spray, baling for very life to free the boat from the water with which she was nearly full, it was some minutes before I was able to decide whether we were still uninjured or not. Then I saw, at a little distance, the whale lying quietly. As I looked he spouted and the vapour was red with his blood. . . . In a few moments he subsided slowly in death, his mighty body reclined on one side, the fin uppermost waving limply as he rolled to the swell . . ."

Some of the boats of the American whaling ships included a shoulder gun in their equipment, by which a small bomb could be fired at a whale from close range. This weapon was very unpopular with both mates and harpooners, however, and they only resorted to it in desperate circumstances.

The crude forms of harpoon gun sometimes used by these 19th century south sea whalers were as unpopular as the shoulder bomb-gun. Between 1772 and 1792 the Society of Arts offered premiums to whalers and others who could improve the very crude harpoon gun then in existence, and a gunsmith at Hull produced an ingenious weapon. This gun was made of wrought iron, and was about 2 ft. long and of $1\frac{7}{8}$ in. bore. The harpoon used with the gun had a double shank and terminated in a knob that fitted the bore of the gun. The gun worked on a swivel and could fire a harpoon 40 yds., but it never came into general use owing to being difficult to work.

Some of the American whaling ships carried a weapon known as the "Pierce darting gun," which was a combination of the shoulder bomb-gun and the harpoon. A brass tube formed the barrel of the gun, and at the butt was a square chamber in which a nipple protruded from the end of the tube. The barrel was loaded with a charge of powder and a bomb similar to those used in the shoulder bomb-gun, and a percussion cap was placed on the nipple and the trigger set. The harpoon, with the line attached, fitted into socketed flanges at the butt and muzzle, and the whole contrivance was aimed at the whale in the usual way. When the harpoon was despatched accurately and forcefully it penetrated the blubber of the whale until the end of a trigger rod on the weapon was driven backward by striking the blubber; this immediately released the trigger and fired the gun. The weapon was cumbersome and awkward to handle, however, and the harpooners were so awed by it that when they used it the harpoon generally missed the whale, or did not penetrate the blubber deeply enough to fire the gun.



Captured whales alongside a whaling ship. Photograph reproduced by courtesy of Sir W. G. Armstrong Whitworth & Co. Ltd., and the "Discovery" Committee, London.

The first really efficient harpoon gun was produced in 1865 by Svend Foyn, a Norwegian who began his career as a sealer in the Arctic Ocean. Foyn saw many finwhales in the Polar Regions, and the knowledge that one large whale would yield as much oil as several hundreds of seals roused in him the determination to invent a gun that would enable him to kill them. He devised a crude type of swivel gun and mounted it on the bows of a small steamer. This gun fired a harpoon that had two barbs, and proved efficient for attaching a steamer to a whale. Foyn soon realised, however, that a much more deadly weapon was necessary to kill quickly even the smallest whale, and he resumed his experiments. The problem proved more difficult than he had anticipated, and he had spent all his money, as well as funds loaned to him by friends, by the time he achieved his object.

The improved harpoon gun produced by Foyn was mounted on a swivel like the earlier weapon, and had a range of from 25 to 30 yds. When the harpoon penetrated the whale, the turning barbs crushed a small glass phial of sulphuric acid secured to the harpoon, and the acid escaped and exploded a

(*Continued on page 841*

XXXVI.—A CIVIL SERVANT

THE Civil Service, as it is known to-day, came into being only about 80 years ago. Before that time each Government Department recruited its own staff and there was no standard method of obtaining positions, the possession of influence being of greater value to competitors than ability or a good record. There were no regular scales of pay, and the Service as a whole was notorious for its lack of real efficiency.

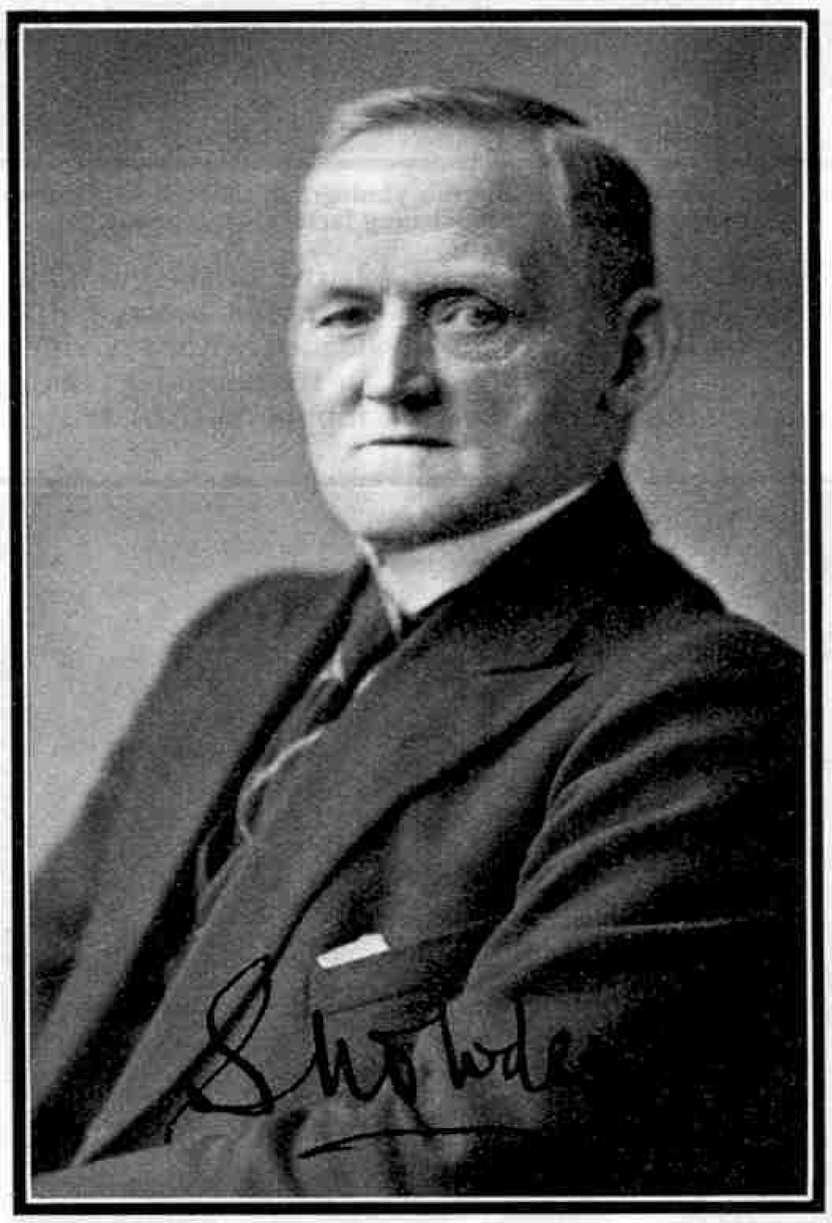
About 1850 dissatisfaction with the position led to an enquiry, the result of which was a recommendation that a permanent Civil Service should be established, and that entrance to it should be secured by means of competitive examination. These proposals were adopted, and the Civil Service Commission was formed to make regulations and to carry on the necessary qualifying examinations. From time to time the regulations have been reviewed and adapted to changed conditions, and the labours of the Commission have built up a capable and efficient body of men and women employed in administrative and executive posts who have established a tradition of public service and form a recognised part of the machinery of national government.

Positions in the Civil Service are usually regarded as "safe" or "sheltered." This is only natural, for those occupying them are specially trained for the particular tasks they undertake, and in certain cases a definite appointment is subject to satisfactory work during a probationary period. Salaries follow definite scales, regular increases are the rule, and there are retiring pensions. At present, pay varies with the "cost-of-living" bonus, an addition to the appointed salary made necessary by the rise in prices since the scales were fixed. It is impossible to make definite statements in regard to prospects, for both salaries and bonus have been subject to certain cuts in recent years, and there is the possibility that further revisions may be made before a new and more settled basis is fixed.

Candidates for positions in the Civil Service must be British subjects by birth, and their parents must also have been British subjects. They are required to pass a medical examination and to produce evidence of good character, in addition to being successful in the examination that is designed to test their educational fitness to take up the type of post desired.

There are no regular dates for the qualifying examinations, for these are held at intervals the length of which depends on the rate at which vacancies occur in the department or class concerned. Ample notice of forthcoming examinations is given by means of advertisements published in certain newspapers. In the London area these appear on Thursdays in "*The Times*," "*Morning Post*," and "*Daily Telegraph*." Explanatory leaflets giving details of the posts open to competition and of the examinations to be held may then be obtained on application to the Secretary, Civil Service Commission, Burlington Gardens, London, W. Application forms may be obtained from the same source. These have to be returned, duly completed, to the Secretary by a specified date, and their receipt is acknowledged.

The Civil Service provides a very large variety of posts, and in the course of a single article it is impossible to deal with them all. Positions in the Post Office come under this heading. These are advertised in the manner already described and the qualifying examinations are conducted by the Civil Service Commission, but the work is of a special character, and therefore will be dealt with in a later article. Other Civil Service posts that have already been dealt with in this series are remarkable in being exceptions to the general rule that an examination must be passed. These include senior legal appointments for barristers and solicitors, medical inspectorships in various Ministries, inspectorships of the Board of Education and similar posts for which high technical and professional qualifications are necessary. Those who are aiming at positions of this kind must first undergo the training required, details of which were given in the articles dealing with the professions involved, and posts are then secured by appointment based on the possession of special qualifications and experience.



Viscount Snowden began his career in the Civil Service. In the open competition for positions in the Excise Service in 1886 he passed with honours and was appointed a junior officer in Liverpool. From there he was transferred to Aberdeen and afterwards served in various parts of the country. He was involved in a cycling accident, and the injuries he received eventually compelled him to resign his post after the Board of Inland Revenue had held it open for two years, in the hope that he would be able to return.

Mr. Snowden, as he then was, then turned to politics, becoming Member of Parliament first for Blackburn, and then for the Colne Valley. He was Chancellor of the Exchequer in the Labour Governments of 1924 and 1929 and until September last was Lord Privy Seal in the present National Government. He was created a Viscount in 1931.

Apart from these cases and others of a similar type in which competition is restricted to nominated candidates, appointments can only be secured by means of examination. The greater number of these are on the administrative and clerical staffs of the various Government departments, and the character of the examination depends on the importance of the posts open to competition. There are three chief divisions, known respectively as Administrative Clerkships, the Executive Class, and the Clerical Class. Successful candidates in these are drafted to one of the principal government departments, the Foreign Office being a notable exception, posts in this department being filled as the result of separate examinations.

The Administrative Clerkships form the highest branch of the Civil Service and formerly were grouped under the title Class I. Candidates must be between 22 and 24 years of age, and an examination fee of £8 is required. Six subjects are compulsory, and these include an essay and an oral test, together with papers in English, General Knowledge, Everyday Science, and a language. A certain number of other subjects may be selected from a long and comprehensive list, and it is noteworthy that those offering a science must produce evidence of laboratory training in an institution of University rank. A high standard of work is required in all parts of the examination, and a University education is practically a necessity for candidates. This is desirable in view of the fact that the duties of those who are

successful in obtaining positions call for a wide outlook and the exercise of resource and initiative.

The work of junior Administrative Clerks is largely of a routine character, but later they are called upon to assist in the formulation of the policy to be followed by their departments in administrative duties, and the higher officers of this class are in close contact with the chiefs of the various Government departments. The commencing pay is £200 a year, rising by annual instalments of £20 to £500 a year, the usual bonus being added. Further progress depends largely on the opportunities available in the Government department in which a position is held, but reasonable promotion is certain, and there is always the prospect of rising to the highly paid chief posts.

The next grade is the Executive Class, the members of which have great responsibilities, for they direct the actual business of the department to which they are appointed, and investigate questions on which information is required for administrative purposes.

Those wishing to secure posts in the Executive Class must be between 18 and 19 years of age. Seven papers are set in the qualifying examination. Three of these—on English, Arithmetic and General Knowledge—are compulsory, and candidates complete the examination by taking papers in subjects selected from an additional list. A fee of £4 must be paid by all candidates. A good education of public or secondary school standard is a necessary preparation for the examination, and in general this type of post is regarded as one that can best be filled by a well-informed and intelligent youth who has attended a good school, but not a University.

The commencing salary of this class is £100 a year, exclusive of bonus, and annual increments of £10 raise this to £130 a year. Further rises of £15 a year bring the Executive Clerk's salary to a maximum of £400 a year, but those who have ability to occupy important posts with credit to themselves have prospects of promotion to higher rank with correspondingly increased pay. It is impossible to give definite details of these, however, for the type of position varies considerably from one department to another.

Last comes the Clerical Class, consisting of those who carry out all clerical duties, except those that are mechanical in character and are performed by typists and other female assistants. There are two sub-divisions, the General Clerical Class and the Departmental Clerical Class. The second of these divisions consists of clerks in the Customs and Excise and Inland Revenue Departments, the Admiralty and other ministries. In all cases the work consists of the preparation and checking of statements, accounts, statistics and returns. Members of the Clerical Classes normally work between seven and eight hours a day.

Vacancies in the Clerical Class are filled by boys between 15 and 17 years of age who are successful in a special examination consisting of compulsory papers in English and Arithmetic, and optional papers in five other subjects, one of which is a language. It is not essential to take the whole of the five optional papers, and generally speaking it is better to do good work in a selected number of these than to make a moderate showing in all of them. A high standard is required, and if thought desirable the examination may be held in two parts, the first part being employed to select the best of the candidates, who are then admitted to the second part.

The examination is held in London and also in a number of provincial centres, and a fee of 10/– must be paid when returning application forms to the Secretary of the Civil Service Commission. This fee is not returnable, and a further fee of £1/10/–, making a total of £2, is required from every candidate attending the examination.

As far as possible successful candidates in the Departmental Clerical Class are allowed to enter the departments they prefer, but they must be prepared to take up duty where required. In the General Clerical Class salaries, exclusive of bonus, commence at £60 a year, rising to £80 a year at the age of 18. Annual increments of varying size eventually lead to a maximum salary of £250 a year, and it may be noted that no member of the class may proceed beyond £180 a year without securing a special certificate of competency. In the Departmental Class there are prospects of promotion to higher grades that carry with them correspondingly higher salaries. The scale of salary of the Customs and Excise Departmental Clerical Class is the same as for the General Clerical Class.

The illustration on this page is a view of Somerset House, London, from the Thames. Somerset House is closely associated with the Civil Service, for it is the headquarters of the Board of Inland Revenue and houses other public offices, the most famous of these being the General Register Office, in which are kept records of births and deaths and census returns, and the Probate Registry, where the wills of Shakespeare, Nelson, Wellington and other famous men may be seen.

Our illustration of Somerset House is taken from an official photograph of H.M. Office of Works and is here reproduced by permission of the Controller of H.M. Stationery Office.

In addition to the general Civil Service positions so far dealt with, there are many special posts in various branches. It is impossible to describe all of these separately, and details of only a few of the more important can be given. Further enquiries regarding these, or any Civil Service post not specially mentioned here, may be obtained by writing to the Editor of the "*M.M.*"

One special post of this kind is that of Officer of Customs and Excise. The duties on which such an official is employed include the examination of cargoes imported into the country, or exported from it, in order to fix liability to duty, and the inspection of distilleries, breweries, artificial silk factories, tobacco factories and other works in which dutiable articles are manufactured or handled. In addition there are various miscellaneous duties, including the investigation of old age pension claims. Officials may be employed in any part of Great Britain and Ireland. The scale of pay begins at £120 a year, rising by annual increments, first of £10, and then of £15, to £450 a year, bonus being added. Promotion to higher grades brings with it increased salaries.

The limits of age for entry to the examination for this branch of the Civil Service are 19 and 21 years, and the fee payable is £3, of which £1 must be paid for permission to attend the examination. In the examination itself six papers must be taken in addition to an oral examination designed to test the candidate's personal qualifications for the work he hopes to undertake. The subjects of the written examination are English, Mathematics, General Knowledge, Science, and two others selected from Further Mathematics, History and Geography, Economics and Elementary Politics, and a language, which may be Latin, French or German.

A Civil Service post that is attractive to mechanically-minded boys and young men is that of (*Continued on page 841*)

Making a Film of Michael Faraday

Behind the Scenes at the B.T.H. Studio

IN September, 1931, the centenary of the discovery of electro-magnetic induction by Michael Faraday was celebrated in London by an exhibition of his work, and an interesting film showing briefly how Faraday made his great discovery was produced for the occasion by the British Thomson-Houston Co. Ltd., Rugby, to whom we are indebted for the information contained in this article.

The acoustical laboratory, which is part of the engineering laboratory, is specially designed to serve both as a studio in which sound and picture recording can be carried out, and as a theatre in which talking film apparatus can be tested and films presented. For studio work flood and spot lights, and picture and sound recording apparatus similar to that described in the "*M.M.*" of April, 1931, are available; and all the usual theatrical paraphernalia is marshalled when serious "shots" have to be made.

At the outset of making the Faraday film it was realised that there was no one better qualified to tell the story than Sir William Bragg, Faraday's successor at the Royal Institution, London. Sir William was approached, therefore, and he took up the task with characteristic enthusiasm and energy. His unfailing courtesy, and his great ability as a lecturer and manipulator of apparatus greatly lightened the labours of the laboratory staff, who much enjoyed the privilege of working with him.

A scene from the film, showing "Faraday" conducting his experiments. The illustrations to this article are reproduced by courtesy of the British Thomson-Houston Co. Ltd., Rugby.

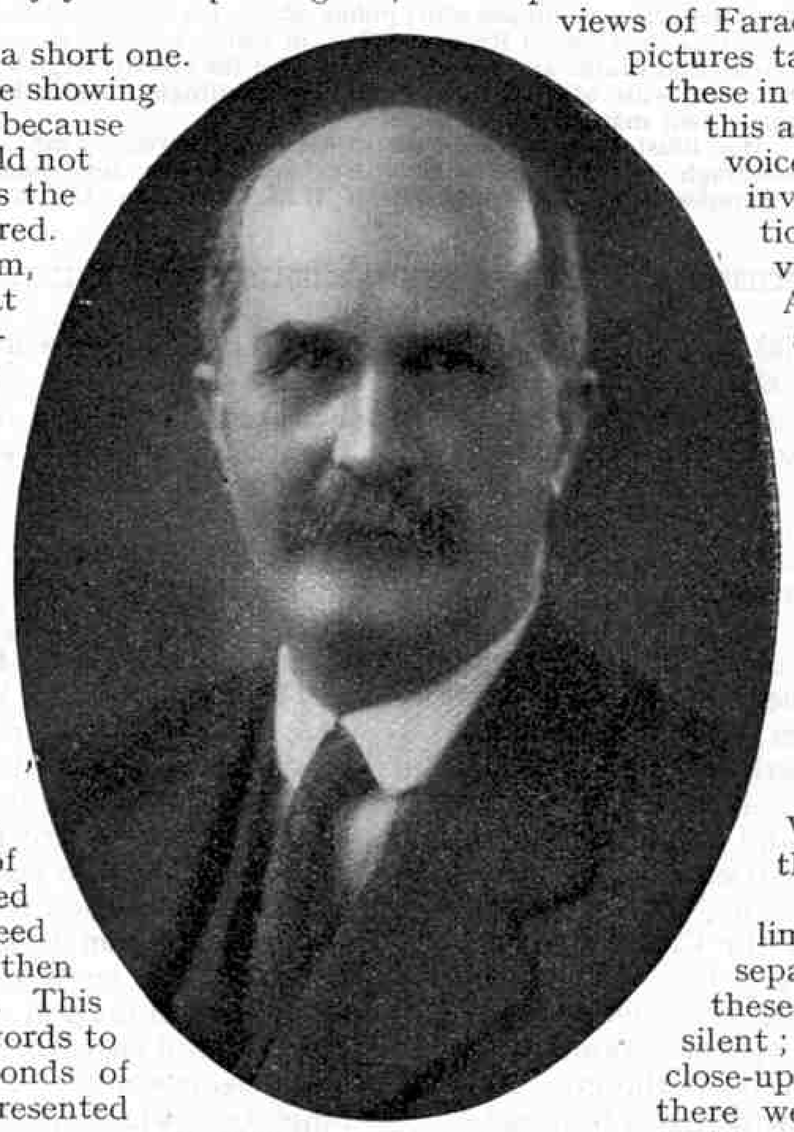
It was decided that the film should be a short one. It occupies in fact less than 10 minutes in the showing and this limitation was deliberately imposed because it was realised that a film of greater length would not be acceptable to normal exhibitors, and thus the chance of general distribution would be impaired. Of course the main objective was to make a film, historically and scientifically accurate, that should be exhibited at the various centenary exhibitions. It was felt, however, that if a wider public could possibly be reached through the medium of some of the better class regular cinemas, the value of the work as an appreciation of the genius of Faraday would be greatly increased. Limiting the duration of the film to less than 10 minutes proved to be a serious technical consideration, however, as it was a matter of considerable difficulty in so short a space of time to arrange proper prominence and emphasis for the details of the story in view.

In the making of a film the scenario is the master manuscript to which everybody engaged on the production works. A series of discussions with the Faraday committee decided the precise scope of the film, and an agreed scenario was drafted by Colonel Vignoles and then modified and approved by Sir William Bragg. This scenario finally contained the appropriate words to be recorded, spaced out accurately in seconds of time, and detailed all the pictures to be presented at the corresponding times.

With Sir William's approval and permission the staff spent several days at the Royal Institution, examining, drawing and photographing Faraday's apparatus, consulting his notes with Mr. Martin, the Secretary of the Royal Institution, and photographing and drawing the lecture theatre and table. With the help of the Royal Institution architect they were able to design a reconstruction of Faraday's lecture theatre and table, and these together with the experimental apparatus were accurately constructed and set up in Rugby exactly as they were 100 years ago. The staff also borrowed from the Royal Institution a collection of old glass apparatus with which to furnish the background of Faraday's table; and they photographed several additional portraits of him, especially some by permission of Professor Clinton at University College, London.

Then followed a search for someone who would with dignity and understanding impersonate Faraday during the time that Sir William was describing the actual experiments performed a century ago. By good fortune this need was soon met, for a gentleman on the B.T.H. staff was found to be willing and fitted to undertake the part.

It was decided to maintain the voice of Sir William Bragg telling the story throughout the entire length of the film, and to interpose all the close-ups of notebooks, experiments, etc., the views of Faraday doing his experiments, and the outside pictures taken in various parts of the country, fading these in as the figure of Sir William was faded out. By this arrangement the sound track of the speaker's voice was maintained without a break. The method involved many intricate photographic manipulations, a considerable amount of rehearsing, and very accurate timing.



Sir William Bragg, O.M., K.B.E., F.R.S.

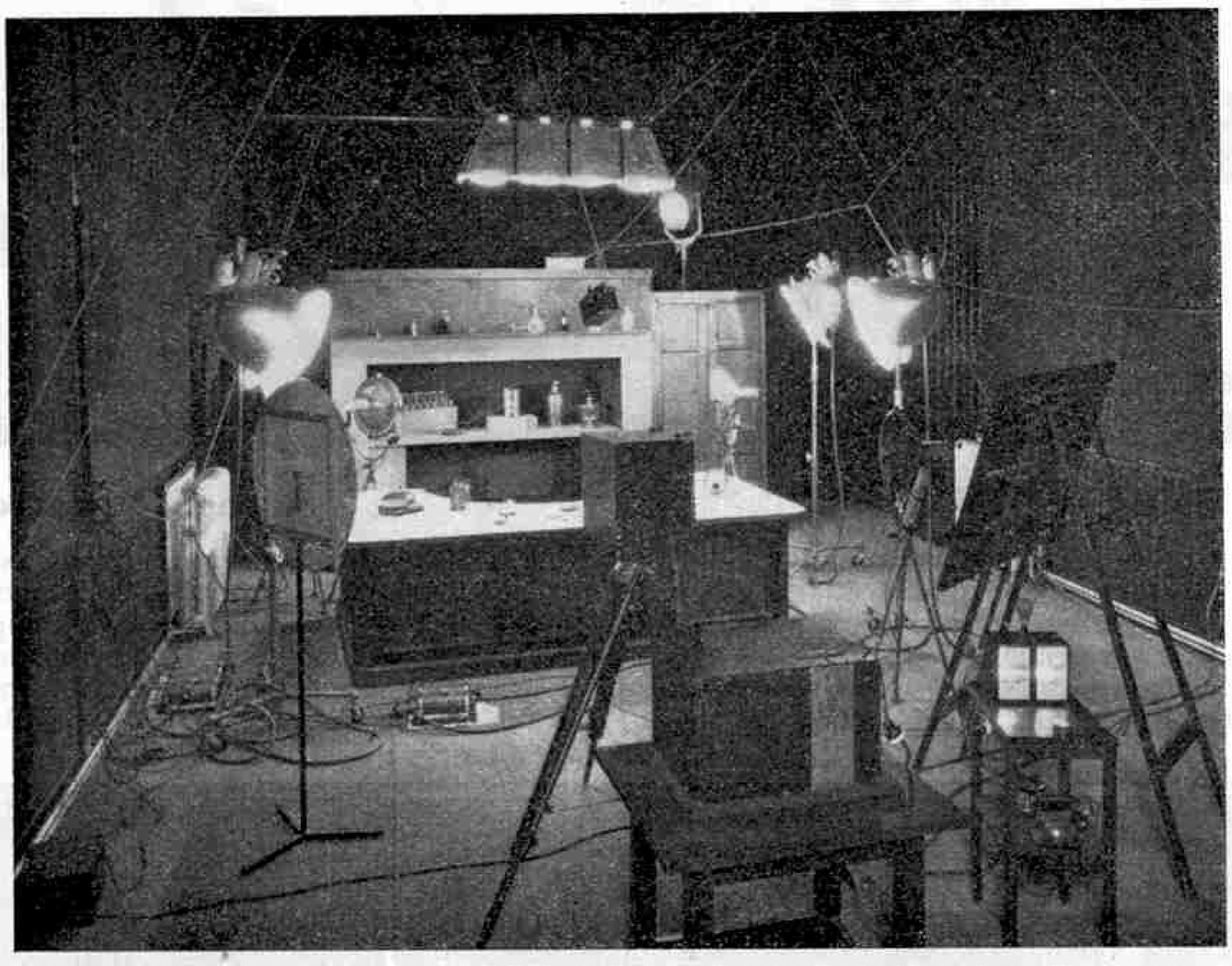
After some months of preparation, during which several experimental lengths of film were made to test the recording equipment, Sir William Bragg visited the laboratory and the sound and picture record of the lecture was made. One of the accompanying illustrations shows the apparatus and "set" in the laboratory just after the film had been shot. Silent pictures were then taken of "Faraday" carrying out some of his experiments; various close-ups were made to illustrate the action of the story; and pictures of electric trains, trams, cranes, power lines, etc, were taken. All these were substituted at appropriate points for the pictures of Sir William Bragg, but his voice was left intact throughout the film.

In making the film, quite apart from the preliminary experimental work, more than 40 separate lengths of film had to be shot. Some of these lengths were sound and picture, others were silent; some were normal studio shots, others were close-ups; yet again others were "outsides," and there were also several "stills." All these had to be developed, printed and viewed. The pieces to be finally employed were decided upon and then

joined up in their correct sequence and in such a manner that gradual fades were arranged at all points, and synchronism with uninterrupted sound track was achieved.

Those who saw all the detail of the making of this film, which required something like seven months of continuous work, are able to realise more fully than ever before what a wonderful thing is this new medium of education, of recording history and of entertainment. They saw the making of a record spoken by a great authority of the work of a very great man—a record that perhaps will be brought out and shown to scientists in 100 years' time when they gather again to do homage at the second Faraday centenary.

It is a wonderful thought that the figure of Sir William Bragg, his experimental skill, his smile and his intimate gestures should be indelibly preserved by optical and chemical science, and that his voice and words, generating only something like one hundredth of a microampere in the microphone should be made available in all their natural features of charm and eloquence for 100 years to come by the agency of acoustical, electrical and chemical science tracing a little wriggley sound track only seven-hundredths of an inch in width, and extending along the side of the film. We all can feel gratified that it is thus possible to-day to preserve for future generations the voice, the appearance, and even the personality of our eminent men. At the same time we cannot avoid regret that such a thing could not be done in the time of the great philosophers of the past, among whom may be specially placed Faraday, the subject of this film, who did more than any other man to make possible the great developments of electrical science.



Faraday's desk and apparatus in the B.T.H. studio just after the film had been shot. The photograph also shows the powerful arc lamps directed toward the table, the microphone suspended above it, and the film camera in the foreground.

Faraday with all his wonderful foresight and with all his genius could not possibly have foreseen this. He little thought when, as a lad, he pored over his master's books, binding the loose pages into finished volumes, that he was destined to do so much in electricity, physics and chemistry towards the realisation of this magic bookmark, which will enable coming generations to turn back pages of history and bring to life the great pioneers of former days. The wonderful story of how Faraday became one of the world's most famous scientists was told in the "*M.M.*" of August and September, 1931.

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From all Booksellers

HARRAP

What Shall I Be ?—(*Continued from page 839*)

Examiner in the Patent Office. The duties of Examiners are to report on applications for patents in order to ensure that they comply with the patent laws, and thus the post carries great responsibilities. The number of vacancies varies from time to time and appointments are not held every year. Candidates must be between 20 and 25 years of age, and they are required to undergo an examination of a scientific character, in which high marks are awarded in a special paper on a subject selected from Mechanical Engineering, Electrical Engineering, Industrial Inorganic Chemistry and Metallurgy, Industrial Organic Chemistry and Advanced Physics. A fee of £4 is required from each candidate. Successful candidates are appointed Assistant Examiners at a salary of £150 a year, rising by annual increments of £15 to £400 a year.

Another important Civil Service position is that of Inspector of Taxes in the Inland Revenue department and this offers scope to those who are quick at figures and are attracted by accountancy problems. A Tax Inspector ascertains the liability to income tax of individual tax-payers and large trading concerns, and his work calls for the exercise of great skill and tact, in addition to ability to conduct negotiations and appeals. The post is therefore a highly responsible one. The commencing salary of an Assistant Inspector, exclusive of bonus, is £160 a year, rising by £15 annually. Promotion to higher rank depends on satisfactory service.

The regulations governing admission to the Foreign Office and Diplomatic Service, and to the Indian and Ceylon Civil Services, differ from those applying in other cases, the special necessities of positions of this kind making it essential to scrutinise carefully the qualifications of candidates. The examination is similar in scope and standard to that for admission to the Administrative Class and is taken between the ages of 22 and 25 years. but before candidates are allowed to take it they must appear before a Board of Selection that meets annually.

Publications referring to the examinations conducted by the Civil Service Commission may be obtained from the Secretary at the address already given. A full list of these publications, together with useful general information, is given in a special leaflet G.1, and candidates for posts in the Civil Service are advised to write for a copy of this, for it also gives details of approaching competitions. Further information and advice in special cases may be obtained from the Editor of the "*M.M.*"

Romance of Whaling—(*Continued from page 837*)

bomb forming the point of the harpoon. The gun enabled the harpoon to be aimed with much greater speed, accuracy and force than was possible with the hand harpoon or with any of the crude harpoon guns then in use, and made possible the hunting of finwhales. Foyn's harpoon gun has been improved in minor details from time to time, but in principle it is the same to-day as when he invented it in 1865.

The harpoon used in the modern harpoon gun is about 4 ft. in length and weighs about one ton. Four-hinged barbs, each 1 ft. in length, are contained in the head of the harpoon, and open out in the body of the whale. Three seconds after the harpoon strikes the whale a time fuse ignites an explosive contained in a cap forming the point of the harpoon. The gun is fired by a charge of 220 grammes of explosive contained in a cotton bag secured to a wooden buffer that acts as tamping.

Of General Interest

How Neon Tube Signs Work

Many of the so-called neon tubes employed in the advertising signs that are such a brilliant feature of the streets of large cities do not contain neon at all. The earliest tubes of this type did contain this rare gas, which gives a brilliant red glow, and the name has been given to similar tubes containing other rare gases that also glow, but with different colours, when excited by the passage of high voltage current. These gases include helium and argon, tubes containing the former giving a white glow and those containing the latter having a faint lavender colour. The gases are not used alone in commercial signs, however, for the argon tube does not give a brilliant glow, and helium is too expensive. Argon is used in combination with mercury vapour when a tube showing a blue colour is required, and if this combination of gases is used in a tube made of yellow glass the resulting illumination is green.

Helium, neon and argon are members of a family of rare gases all of which are found free in small proportions in the atmosphere. Argon is the most abundant, for it is present to the extent of 0.75 per cent. Only about one-tenth of one per cent. of the atmosphere is helium, however, and neon is present in even smaller proportion. All have the singular property of being chemically inactive, and no compounds containing them have been made or discovered. The best known of them is helium, which is found in the gases above certain springs, chiefly in the United States and Canada.

Neon tubes are prepared by pumping out air and allowing the gas to enter at the required pressure, which is much less than that of the atmosphere. A high voltage is necessary in order to start the flow of current through a tube of this kind, but when the glow or discharge, which extends throughout the tube, has begun, it continues with the application of a lower voltage. Ordinary mains current is not of sufficiently high voltage except for very small lengths of tube, and for this reason special transformers are employed in order to step up the current to the voltage required.

One of the largest neon tube signs recently erected in London is 165 ft. in length, and consists of nearly a quarter of a mile of glass tubing. The lettering is 4 ft. in height and is blue and red in colour, the second of these colours being employed as a shading for the first. The sign also includes a pictorial design carried out in blue and old gold, neon tubes containing helium being employed to give this effect; and a bright green border surrounds the entire advertisement.

A radio "fan" at home! An American wireless enthusiast working in his laboratory on the construction of the metal chassis of a multi-valve radio receiver.

Strange Forms of Glass

A striking development in the glass industry is the production of what has been described as armour plate glass, a sheet of which only $\frac{1}{4}$ in. in thickness will support a weight of more than 3 cwt. A piece of this thickness measuring 3 ft. by 1 ft. sags 2 in. when supported at its ends and loaded with this weight in the middle, the material being flexible to a certain extent.

There is a legend that flexible glass was discovered in Rome nearly 2,000 years ago, but that the producer was put to death by the Emperor. The best substitute for this ideal material so far produced is laminated glass, which consists of two sheets of plate glass separated by one of celluloid or a similar substance, the three being firmly cemented together. Glass of this kind is not shattered when broken by a heavy blow, and for this reason is largely used in motor cars. It suffers from the defect that some forms of it are coloured, while others become slightly discoloured from exposure to light, and possibly the new glass may displace it altogether.

An even more surprising form of glass is that known as glass silk, which consists of finely-spun threads of glass woven together. It is largely used for covering boilers and steam pipes, for the glass itself is a good insulator, and the sheets of glass silk employed for this purpose contain a large number of tiny pockets of air that further help to reduce the rate at which heat passes through.

It is interesting to know that glass is one of the most durable of substances, and many specimens of glass made in Egypt about 3,500 years ago are in as good a condition to-day as when they were made. Certain types of modern glass are not so durable, but it has been discovered that slight errors in proportioning their constituents are the cause of their decay.

What Men Are Made Of

The chemical analysis of a human being shows that he contains enough carbon to make 9,000 lead pencils, sufficient phosphorus for the manufacture of 2,200 matchheads, and as much iron as would make a medium-sized nail. He also contains a small amount of magnesium, together with enough lime to whitewash a chicken coop, and a trace of sulphur; and the amount of fat in his body is sufficient to make seven one-pound bars of soap. The rest is water, the body of an average man containing sufficient to fill a ten-gallon barrel.

The Snow-Capped Peak of Kilimanjaro

The illustration on this page shows the crater of Kibo, one of the two peaks of Kilimanjaro, the highest mountain in South Africa. Kibo is 19,321 ft. in height, and the second peak, which is called Mawenzi, is nearly 2,500 ft. lower. Both peaks are volcanic in origin and are seven miles apart, an immense saddle-like formation 14,000 ft. in height connecting them. As our illustration shows, Kibo is an almost perfect crater in form. Although it is situated almost on the Equator, it is permanently covered with ice and snow from which great glaciers descend, one of these reaching nearly 6,000 ft. down the side of the mountain. There is no permanent ice cap on Mawenzi.

A photograph of the crater of Kibo, the highest peak of Kilimanjaro, taken during a flight to East Africa by Mr. W. Mittelholzer, a famous Swiss pilot, to whom we are indebted for this illustration.

Kilimanjaro is in Tanganyika Territory, which was a German colony from 1886 until the end of the War, when it came under British protection. The great mountain was discovered in 1848 by a missionary who ventured into the then unknown hinterland of the east coast of Africa. His report of the existence in the heart of the continent of mountains that were covered with snow was received with incredulity, but very soon other explorers confirmed his statement. The mountain was first ascended in 1889 by Dr. Hans Meyer, a German scientist who led many expeditions to study the great extinct African volcano.

Our photograph of the crater of Kibo was taken by Mr. W. Mittelholzer, a Swiss airman who flew over it in a Fokker fitted with an Armstrong Siddeley "Lynx" engine. Mr. Mittelholzer has made many flights over Africa. In December 1926 he crossed the continent in a Dornier seaplane, visiting the Central African lakes on his way to Capetown. Later he made a second flight to East Africa, and it was then that he flew over Kilimanjaro. In a further flight from Zürich he flew to Morocco, and across the Sahara Desert to the Niger River and Lake Chad, via Dakar and Casablanca. In this last flight, using a Fokker with an Armstrong Siddeley "Lynx," he covered a distance of about 10,600 miles.

The Oldest Rocks in the World

The oldest of the rocks to which approximate ages can be assigned comes from Manitoba, Canada, and is believed to be about 1,800,000,000 years old. It was molten when laid down and was injected into the surrounding rocks, which must therefore be even older. How old these rocks are we do not know, but the intrusive material carries with it a birth certificate in the form of minute traces of the gas helium. These come from the decomposition of atoms of uranium, a radio-active element present in the rock; and as the rate at which the helium is produced from this element is accurately known, the time that has elapsed since the process began may be calculated.

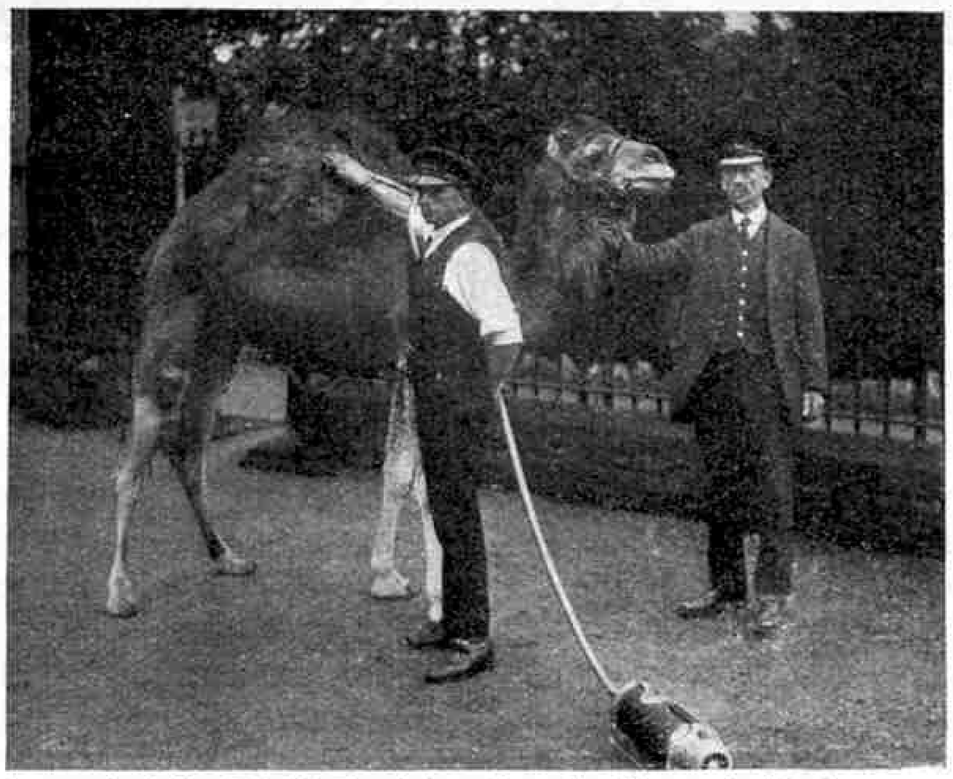
The ages of many rocks have been calculated by similar methods, and until the discovery of the Manitoban specimen, it was believed that a rock from the Black Hills, South Dakota, held the record. This is about 1,500,000,000 years old, and other rocks in Canada and Madagascar are of nearly the same age.

Tropical Valleys in the North of Canada

From time to time rumours have been heard of the existence in the far north of Canada of valleys covered with tropical vegetation. These rumours have recently been confirmed by an expedition that surveyed the borders of British Columbia and Yukon, and it is now known that there are at least two valleys of this kind, the streams flowing through which find their way into the Liard River. A prospector from Yukon lived in one of them for two years. Unfortunately he was drowned when on his return to the nearest settlement, and the place where he lived has only recently been discovered. The leader of the surveying expedition found a faint track through one of the mysterious valleys in which the atmosphere was warm and soft, and on following it he discovered a hot spring from which steam was slowly rising. Beyond this was the pioneer's garden, now rank and overgrown.

This remarkable valley is estimated to be approximately 10 square miles in extent, and contains a large number of hot springs, some of which run directly into the creek, while others form pools and small lakes. The vegetation in it is almost tropical in character, for ferns grow to enormous heights and many plants bearing fruits and berries flourish. An interesting feature at the time of the visit was the presence of purple violets of remarkable size. Apparently the ground is warmed by the underground sources from which the springs of warm water flow, and the air itself is tempered by the steam and hot gases that arise from them.

The second so-called tropical valley is farther up the Liard River and owes its existence to the presence of springs of hot water. In it there is a round hole about 10 yds. in diameter that is filled with hot water throughout the year, and the creek that flows through the middle of the valley itself contains warm water.



A camel at the Bristol Zoo being cleaned with an electrical vacuum cleaner. Photograph by courtesy of Electrolux Ltd.

A Locust Colony in Great Britain

A colony of locusts has been imported into this country and it is hoped that these creatures will eventually form a flourishing colony. This sounds alarming, but fortunately the insects are not free to prey upon the crops of British farmers. Instead they live in a glass case in which they are provided with desert sand and with the grasses that are their favourite diet, and a powerful electric lamp provides them with the heat and light to which they are accustomed in their natural tropical home.

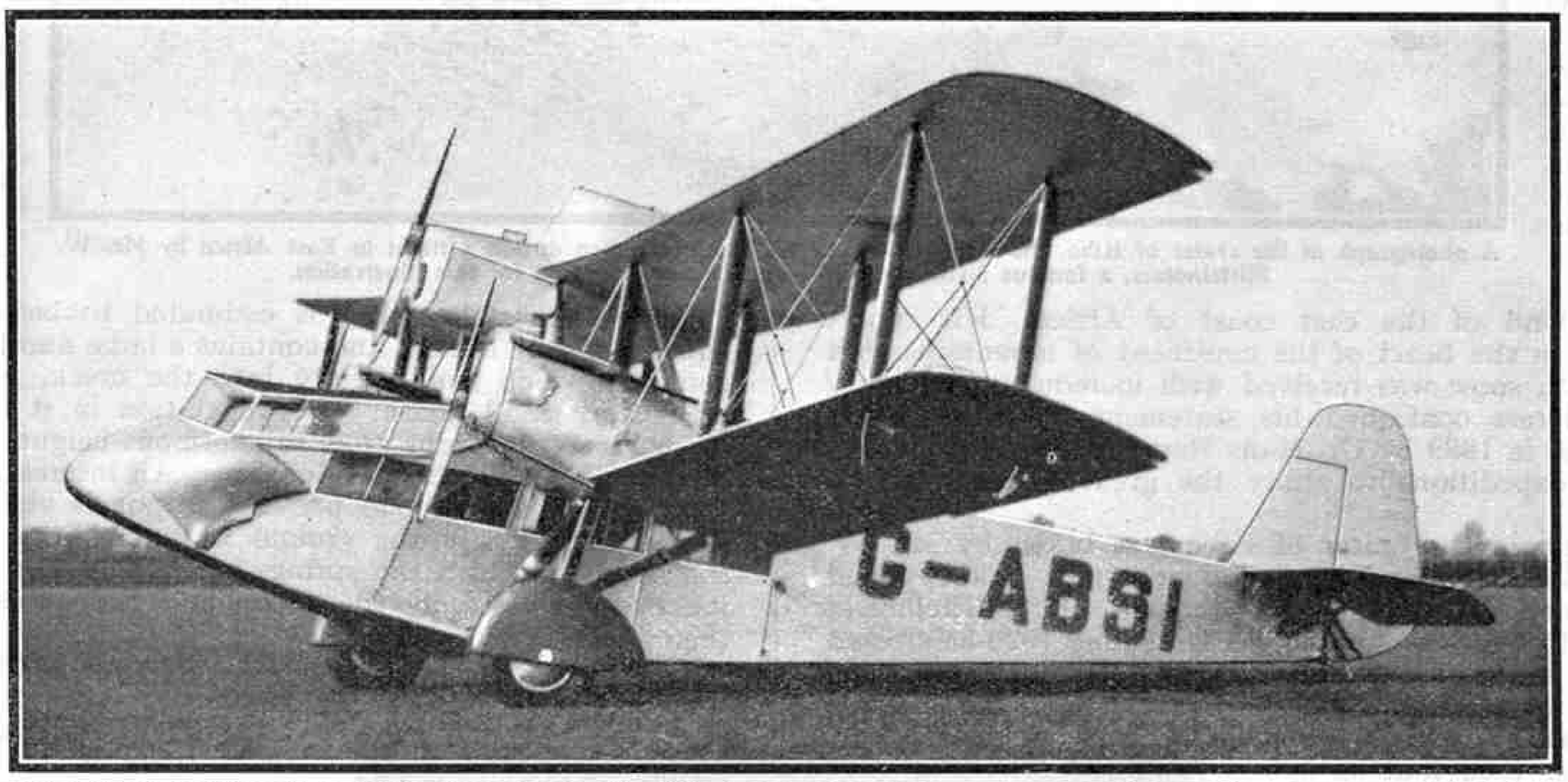
The colony has been established at the Natural History Museum, South Kensington, in order to enable the life history and habits of the insect to be studied in the hope of finding means of exterminating it. Locusts recently have invaded many countries in Africa and Asia, where they have caused millions of pounds' worth of damage. It is impossible to control the present outbreak, but maps showing the progress of the insects month by month seem to show that they spread out from breeding grounds on the shores of the Red Sea and in Southern Arabia and Central Africa, and it is hoped that these will eventually be discovered.

British Aircraft Developments

III.—The Airspeed "Ferry"

DURING the past few years there has been a tendency among aircraft designers to produce faster machines for civil purposes. American designers have led the way in this respect by introducing fast aeroplanes for use on transcontinental passenger and mail services, and their example has been followed in Europe. The faster machines now appearing on the market usually carry far less pay load per horse power, and stall at a higher speed, than the older slower types, however, and increased speeds also bring with them higher initial and operating costs. These are serious points, for they retard the development of aviation by placing machines beyond the reach of many possible purchasers.

With these facts in mind, Airspeed Limited, of York, have designed a triple-engined passenger aeroplane that is not intended for record-breaking flights on long transcontinental routes, but is valuable for short exhibition flights, for joy-rides or for use on feeder air lines where the volume of traffic is not very great. In its own sphere it is economical to operate, and it is claimed that it will often make a profit where many other types of aircraft would operate at a loss. The makers describe it as a machine "with a large cabin and a small petrol tank." Its characteristics may be stated as high pay load for the engine power employed, a short run to get off, and low first cost. Also it will operate on ordinary motor car petrol and oil.



A general view of the Airspeed "Ferry" at rest. For this photograph, and the upper one on the opposite page, we are indebted to the courtesy of Airspeed Ltd., of York.

Some idea of the reliability of the machine may be gained from the fact that the type was first ordered by Sir Alan Cobham, for use during his National Aviation Day Campaign. The machine was designed, built and flown in less than 10 months, in spite of the fact that, except for a small glider, it was the first aircraft built by the firm.

The Airspeed "Ferry" is a short-range passenger-carrying biplane, with accommodation for one pilot and 10 passengers. It possesses a number of unusual features, the most remarkable being the disposition of the three engines. One of these is placed on each side of the fuselage. The third is in the centre of the upper wing, immediately above the fuselage, where it is able to work far more efficiently than if it were mounted in the nose of the fuselage, and where its propeller is out of the way of unwary people who might walk into it when the engine is being run up on the ground. There is no risk of this kind in the case of the side propellers, for they are above the wheels of the undercarriage.

The fuselage of the machine is of semi-monocoque construction, having spruce longerons and web members, covered with birch three-ply. The pilot's cockpit is situated in the nose of the fuselage. Access to it is obtained through the cabin, and there is a large emergency door, glazed with celluloid, on the right-hand side. The view from the pilot's seat has been given special consideration. The windscreen slopes in two planes and is provided with a sliding panel for use in bad weather. On the left-hand side is a sliding glass panel, which can be slid completely out of the pilot's line of vision.

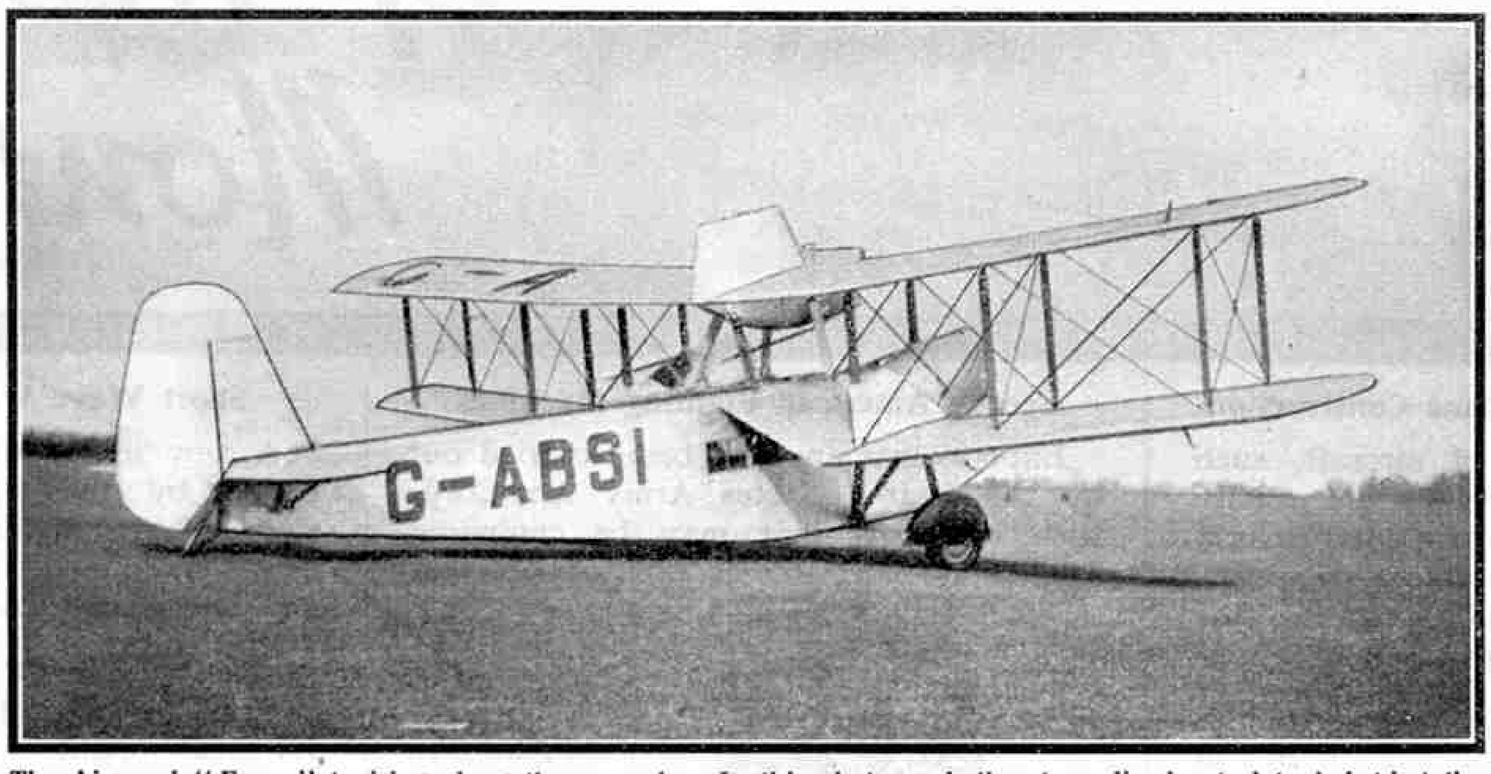
The cabin is immediately behind the cockpit, and is 12 ft. 7 in. in length, 3 ft. 9½ in. in width and 5 ft. 9 in. in height. Windows extend the full length of the cabin, and these have sliding panels 13½ in. in depth. A better view is obtained from the cabin than from the interior of most biplanes, for the lower wings are connected to the top of the fuselage and not to the bottom. In order to expedite the rapid entry and exit of the passengers two doors are provided to the cabin, one on each side of the machine. This arrangement should save a considerable amount of time, particularly when the machine is engaged in joy-riding operations, for while the last three or four departing passengers are leaving the machine on the starboard side, those entering may be taking their seats in the front of the cabin. Entry and exit to the machine is very simple, for the cabin floor is only 1 ft. 3 in. from the ground.

The doors with which the cabin is provided are large and are provided with the usual "slam" lock, in addition to safety locks. An emergency exit also is provided. This is situated in the roof at the back of the cabin, where it is unlikely to be damaged in the event of a bad crash. The door in the side of the pilot's cockpit also

may be used as an emergency passenger exit.

The wing structure of the "Ferry" is of normal design, and is provided with ailerons of the Frise balanced type. All the spars are of spruce and three-ply box construction, the ribs being of wood. The drag struts are of steel tubing. The use of wood in the construction of the wings and the fuselage should facilitate the carrying out of emergency repairs.

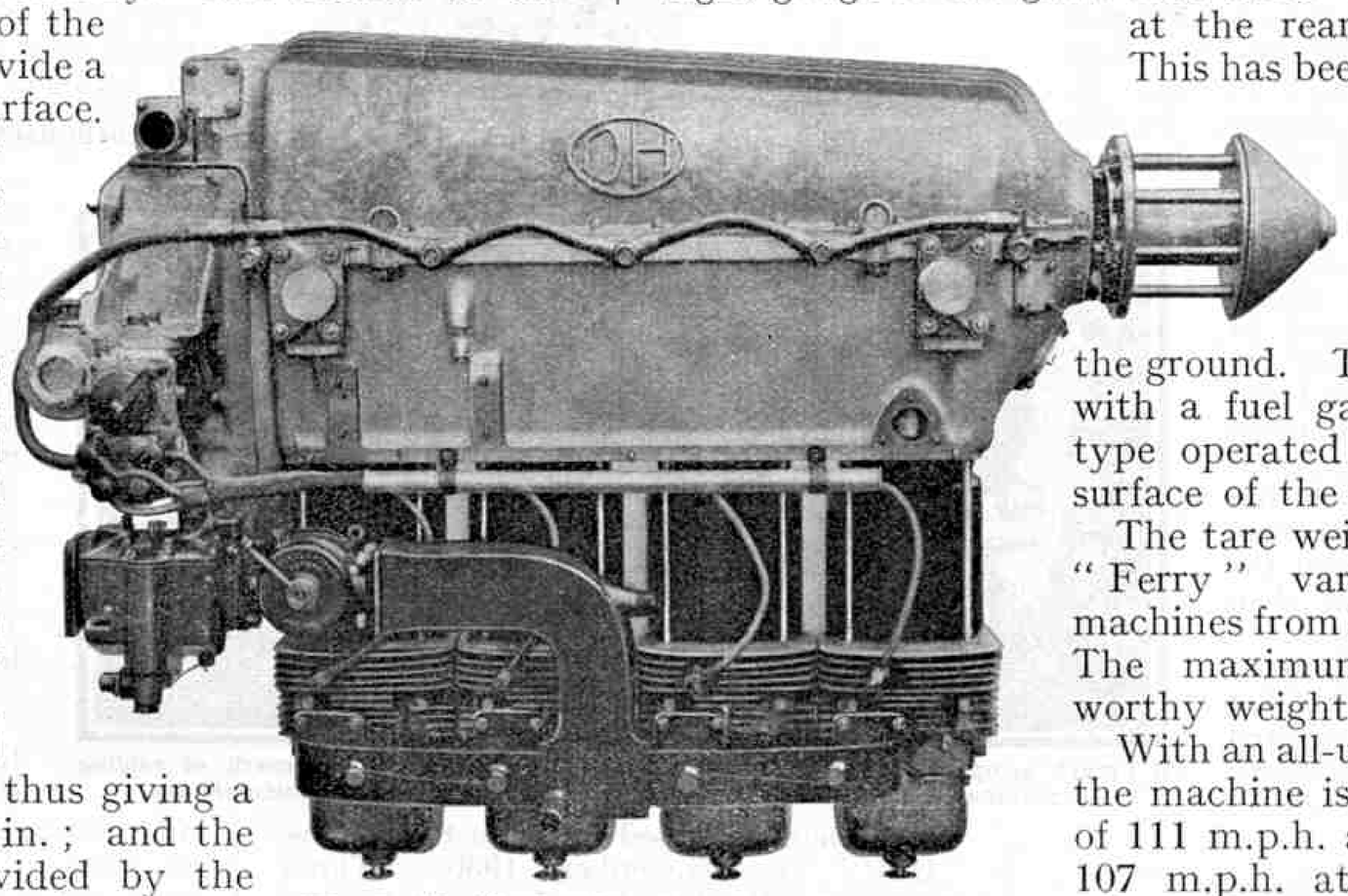
Great care has been taken to make the surfaces of the empennage, or tail unit, robust and safe, and the tailplane is braced by a pyramid of seven struts that meet at a point within the fuselage. The tailplane itself is mounted on two ball races. The rudder has been designed so that it will operate efficiently even when the machine is flying with either of the outboard engines out of action, when control of a machine usually becomes difficult.



The Airspeed "Ferry" taxi-ing along the ground. In this photograph the streamlined petrol tank behind the top engine may be seen, as also may the manner in which the lower wings are secured to the top of the fuselage.

The undercarriage of the machine differs from that seen on most aeroplanes. The wheels are wide apart, the wheel track being 14 ft. 2 in., and the axles stretch out sideways nearly at right angles to the sides of the fuselage. The axle and radius rods are of orthodox design, but advantage has been taken of the favourable position of these two members to fair them together as a unit instead of individually. The section of the fairings is similar to that of the main planes, and they provide a further 35 sq. ft. of lifting surface. In addition to this they give an appreciable cushioning effect upon landing, as they are then close to the ground.

The shock absorber legs with which the wheels are fitted contain steel coil springs that give a wheel travel of 4 in., and on landing a further 6 in. travel is available from a special Oleo damping gear contained within each leg. The spring and the oil systems operate in series, thus giving a total normal travel of 10 in.; and the amount of damping provided by the Oleo gear may be adjusted to meet requirements. The wheels are fitted with Palmer hydraulic brakes.



The De Havilland "Gipsy III," the inverted engine fitted in the Airspeed "Ferry." We are indebted to the De Havilland Aircraft Co. Ltd., for permission to publish this photograph.

A feature of the machine is that all joints are provided with universal knuckles, so that any minor damage due to a bad landing is not transmitted to the fuselage.

The machine is equipped with three De Havilland "Gipsy" engines. Two of these are of the Mark II type, similar to that described on page 104 of our issue for February, 1930; and the third, installed on the top wing, is of the inverted type known as the Mark III. In this way full gravity feed with ample head is obtained for all engines, even when the machine is climbing with its fuel tank practically empty. The side engine frames are standardised, and a large proportion of the spares likely to be required for the two types of engines employed are common to both of them.

The petrol supply is carried in a streamlined petrol tank mounted on the upper plane behind the central engine, a position that gives simple gravity feed to all three carburetters. This tank is capable of holding 60 gallons of petrol. As the machine is essentially suitable for short-range work, and the maximum number of passengers can be carried only with a limited amount of fuel, a special wide pipe line has been fitted in order to enable the tank to be filled quickly.

If desired a larger tank may be fitted in the machine. This will increase the petrol capacity to 105 gallons, and the machine then will be capable of cruising for seven hours. The number of passengers carried when the machine is fitted in this manner is less than that accommodated in the ordinary model.

An interesting and somewhat unusual fitting is a sight gauge of the glass tube boiler type, which is fitted at the rear of the fuel tank. This has been installed to enable the amount of petrol in the tank to be determined readily when the machine is on the ground. The pilot is provided with a fuel gauge of the normal type operated by a float on the surface of the petrol in the tank.

The tare weight of the Airspeed "Ferry" varies with different machines from 3,440 lb. to 3,450 lb. The maximum permissible airworthy weight is 5,600 lb.

With an all-up weight of 5,000 lb. the machine is capable of a speed of 111 m.p.h. at ground level and 107 m.p.h. at 5,000 ft.; and it cruises at a speed of between 90 and 95 m.p.h. at an altitude of 1,000 ft. It requires a run of only 110 yds. to take off in still air, and at ground level it is capable of climbing at the rate of 670 ft. per minute. The time taken to rise to an altitude of 5,000 ft. is 11 minutes, and 10,000 ft. is reached 28 minutes after leaving the ground. The absolute ceiling of the machine is 16,000 ft. When equipped with normal fittings, and carrying a full load of passengers, the machine is capable of cruising for $3\frac{3}{4}$ hrs.

Air News of the Month

Novel Method of Aeroplane Construction

The hollow sections of aircraft, such as the wings and the fuselage, are usually built round a previously erected framework. This method of construction possesses many disadvantages. For instance, the skin of the machine does not play a great part in bearing the stresses, and the framework therefore must be of great strength. A structure built in this manner is also likely to be rather heavy, while a further drawback is the difficulty of showing graphically the shape and form of the curved surfaces involved, and of reproducing the parts of machines from the drawings. In addition, there is always considerable strain between the skin and framework of an aeroplane built on this principle, for the wings and fuselage are slightly flexible, and their movement eventually causes the parts to separate.

A method of construction designed to overcome these difficulties has been introduced by M. Béchéreau and M. Kellner, two French engineers. In this method full-size moulds of the fuselage and wings are made of wood and grooves shaped to hold the metal ribs used to reinforce the fuselage are cut in them. The ribs are then placed in position and metal panels are placed on the moulds and hammered to shape. The finished panels are held in place by means of leather straps while bolt and rivet holes are drilled in them and in the metal ribs, and the parts of the machine may then be taken off for assembly.

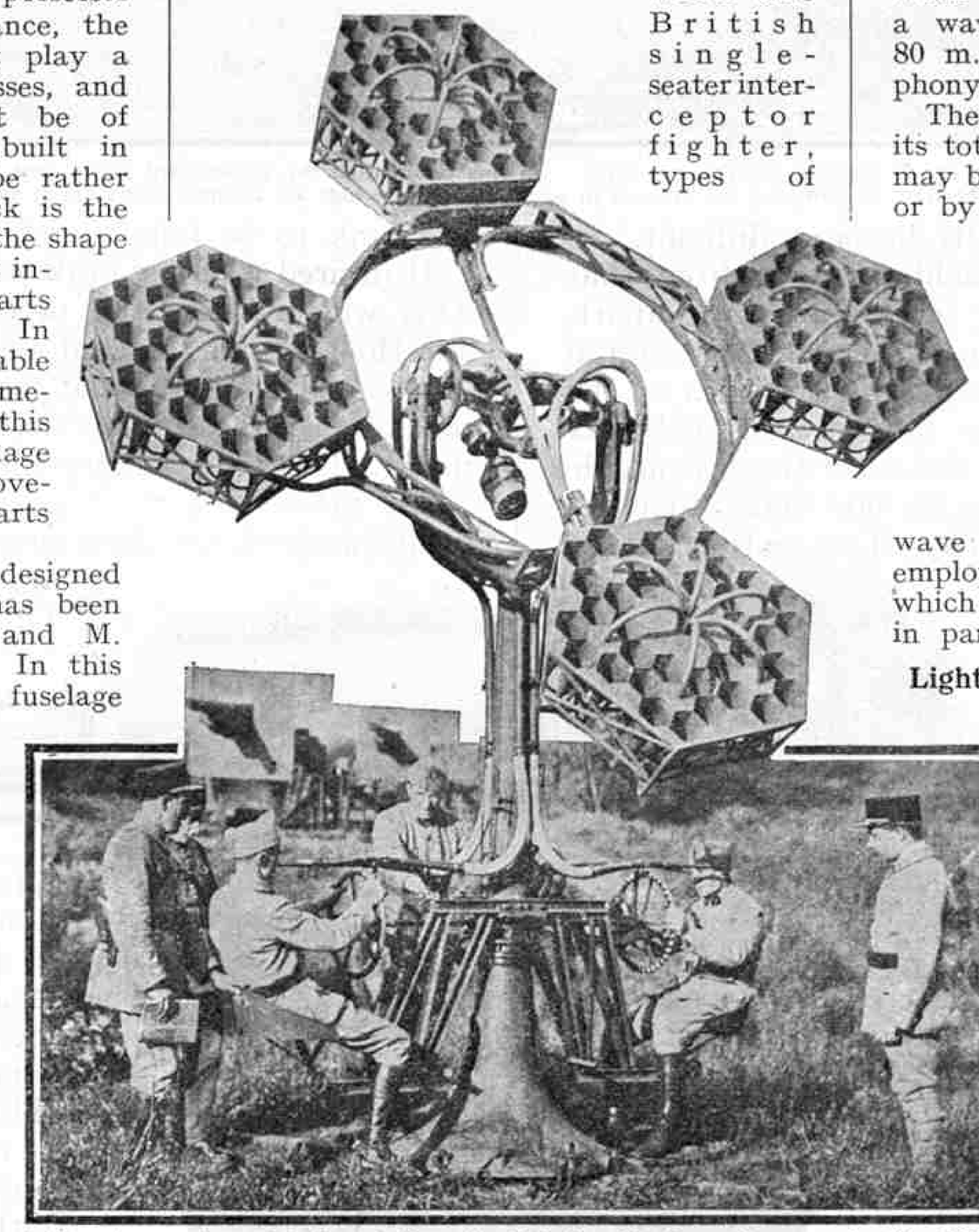
Repairs to machines built in this manner are easily carried out, for any new parts required may be hammered into shape quickly and a perfect fit is ensured.

British Gliding Record

Mr. G. M. Buxton, a British glider pilot, recently set up a new British record for a glider flight with a passenger, by remaining in the air for 2 hr. 33 min. During the flight his sailplane attained an altitude of 1,500 ft. The record was set up at a meeting of the British Gliding Association, at Moorside, Askham-in-Furness, and Mr. Buxton was awarded the Wakefield Trophy, presented by Lord Wakefield, for the best long-distance performance at the meeting.

Speedy American Fighting Machines

Experiments are now being carried out by the United States Army Air Corps with machines that may be compared with the British single-seater interceptor fighter, types of which were described on page 874 of the "*M.M.*" for November, 1930. Three machines of this kind have been constructed by the Boeing Company. They are low wing all-metal monoplanes and are equipped with supercharged Pratt and Whitney "Wasp" engines developing 500 h.p. In their design great attention has been paid to efficient streamlining, the wheels being encased in "spats," and even the telescopic forks on which they are carried being provided with metal fairings. It has been reported that at an altitude of 10,000 ft. the machines are capable of a speed of about 230 m.p.h. when carrying full load and 80 gallons of petrol.



A French aeroplane detection station at which the direction of approach of raiding aircraft may be discovered by means of four sensitive honeycomb microphones.

Short Wave Wireless for Aircraft

A new set of wireless equipment produced by the Standard Telephone & Cables Ltd., for use in aircraft is provided with a short wave unit that has a wavelength ranging from 40 m. to 80 m. This may be employed for telephony, or for C.W. or I.C.W. telegraphy.

The new installation is very light, its total weight being only 80 lb., and it may be used by a special wireless operator or by the pilot of the machine in which it is fitted, a remote control panel being provided for this purpose. Wavelengths from 500 m. to 1,500 m. may be employed on the long wave unit, and the change from one unit to the other is effected by means of a switch. Two aerials are provided, one of the trailing type, normally used for long wave communication, and a fixed aerial, employed with the short wave unit, and which may be used also, with both halves in parallel, for long wave work.

Lighthouses on Transatlantic Air Route

The Brazilian Government have built a lighthouse on a desolate reef off the Brazilian coast, chiefly for the guidance of pilots flying across the South Atlantic Ocean. It is very dangerous and difficult to land on the rugged islands on which the lighthouse has been built, and for this reason it was decided to instal an "Aga" beacon, an automatic device that was invented by Dr. C. Dalen, a Swedish scientist who lost his sight during experiments carried out while designing it.

The lamp of the new lighthouse is switched on automatically at night, or during fog, and extinguished when daylight returns or when the fog lifts; and a special mechanism places a new gas mantle in position when the old one burns out. The beacon will run without attention for more than a year, and is claimed to be the most powerful in South American waters. A second lighthouse has been installed, and this is brought into action automatically if the first one fails.

A third beacon of the "Aga" type has been installed at Calcanhar, a point in the State of Rio Grande do Norte, where fliers on the South Atlantic route usually reach the coast of Brazil.

A New Two-Stroke Aero Engine

For many years aeronautical engineers have been trying to design a really satisfactory two-stroke engine for use in aircraft. One engine of this kind is the Caunter two-stroke engine, which was described on page 938 of the *"M.M."* for December, 1930. Another is the Meteor Mark I, a new engine produced after four years' work by the engineers of the Meteor Engineering Company. This is remarkably simple in construction, only three gear wheels being incorporated in it.

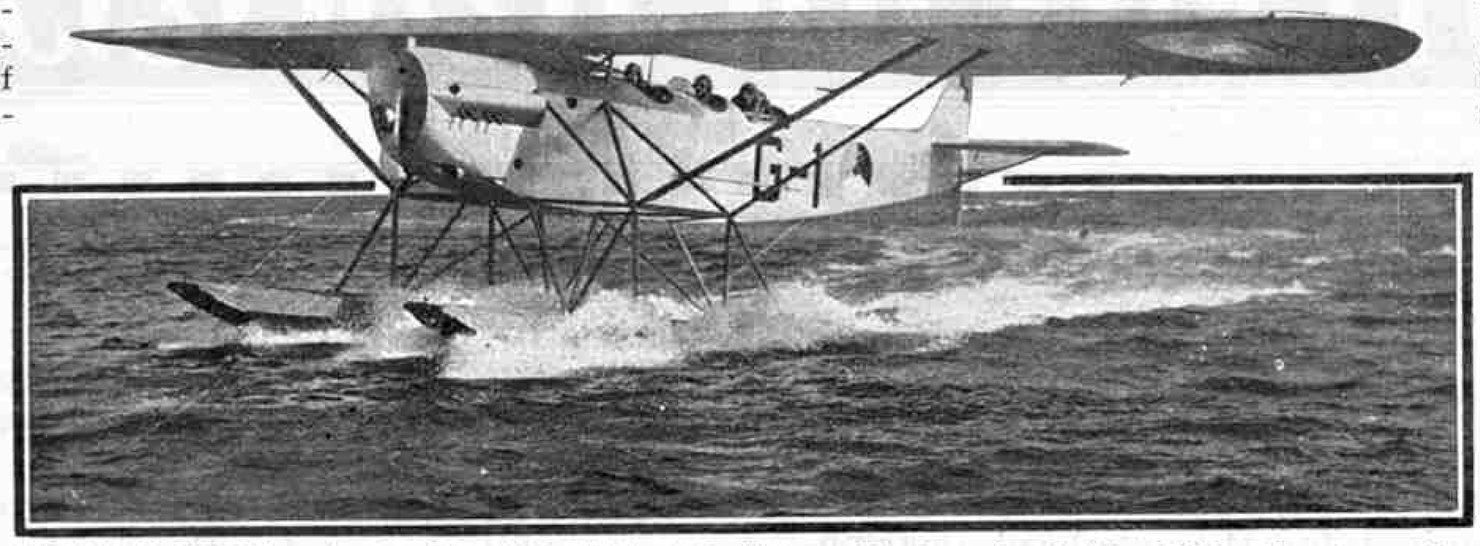
The Meteor Mark I is an eight-cylinder radial air-cooled engine with the cylinders arranged in one bank. The mixture is carried to all cylinders by one induction ring, finding its way in the usual manner through the eight separate crankcases. The cylinders have a bore and stroke of 73 mm. (2.875 in.) and 63.5 mm. (2.5 in.) respectively, and a total capacity of 2,133.6 cc. In order to keep down the cost the cylinders and the pistons are made of cast iron, but when the engine is properly developed it is probable that an alloy of aluminium will be employed for this purpose.

In spite of the employment of heavy metals the engine weighs only 210 lb., and it is thought that the use of suitable aluminium alloys will enable a reduction in weight to 150 lb. to be made. In trials, a speed of 2,000 r.p.m. was reached with a propeller that was not specially designed for use with the engine, but was merely adapted to it. The power developed was 110 b.h.p., and it is confidently expected that when the engine is put into production at least 150 b.h.p. will be obtained at a speed of 2,300 r.p.m. Lubrication of the first engine to be produced is of the splash type, but in later models it is probable that dry sump lubrication will be employed.

Flying Boat for Oceanic Air Mail Service

The French Blériot Company are at present constructing to the order of the French Government a large flying boat for operation on the South Atlantic section of the air mail route to South America. At present the ocean crossing between Dakar and Natal, on the coast of Brazil, is made in fast steamers, and these vessels will be replaced by the flying boat when it is ready for service.

The new machine is of the high wing type and is of all-metal construction. It will be fitted with four Hispano-Suiza engines, each developing 650 h.p., and is expected to be capable of cruising at 110 m.p.h., and of maintaining flight with any two engines out of action. Its range in still air will be 3,000 miles, and its all-up weight more than 22 tons. The substitution of the machine for the steamers will save three days.



A Fokker C. VIII W seaplane on the point of taking off. This machine is equipped with a 450 h.p. Lorraine engine.

Wheel Brakes for Light Aeroplanes

The use of aeroplane wheel brakes greatly increases the safety of a machine when manœuvring on the ground, but so far these accessories have suffered from the drawback that efficient systems have been comparatively heavy and not really suitable for use on light aircraft. A new type of wheel brake has now been produced by the Dunlop Rubber Company that only adds 18½ lb. to the weight of the machine to which it is fitted, and therefore is suitable for use on almost any type of machine.

The Dunlop brake is operated by means of compressed air. When the pilot applies the brake lever in the cockpit, compressed air enters special air-bags shaped like the inner tubes of cycle or motor car tyres, and fitted inside brake drums on the wheels of the undercarriage. As the bags expand they force brake shoes against the drums, small springs pulling the shoes away when the bag is deflated after the brakes have done their work. The brakes may be made to act independently and may be coupled to the rudder bar in order to give differential braking when taxi-ing.

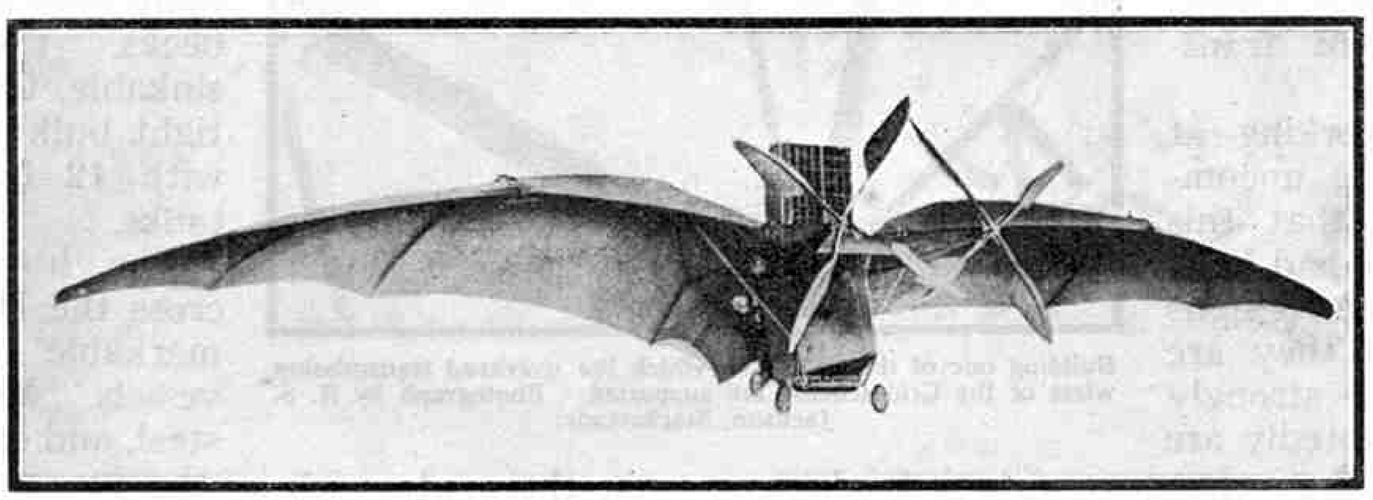
It is claimed that the new brake may be maintained in efficient order with great ease. The only tool required when replacing worn brake shoes is a screwdriver, and the operation can be carried out in two minutes without disturbance to the air-bag.

THIS MONTH'S AIR STORY

Farmer : "What's happening over there, Garge ?"
Garge : "It be one o' they there aviators, master. 'E were doing a bit o' sky writin' and 'e come to a full stop, like. They do say as 'e's in a state o' comma now."

World's Altitude Record for England

Mr. C. F. Uwins has set up at Bristol a new world's altitude record. He reached a height of about 45,000 ft., or more than eight miles, in a Vickers "Vespa" fitted with a Bristol "Pegasus" engine.



The machine in which Clement Ader, a French pioneer of aviation, made what is sometimes claimed to be the first flight in a heavier-than-air machine. The claim is not officially recognised. The story of Ader's experiments was told on page 337 of the "M.M." for May of this year.

Imperial Airways News

The new Imperial Airways desert air service between Palestine and Iraq, mentioned on page 751 of our last month's issue, will enable passengers travelling from London to Iraq, or in the reverse direction, to utilise aeroplane, steamer and train in a combined journey offering many advantages over the usual surface route. Those making use of the new service fly from London to Paris and then proceed by train to either Trieste or Brindisi. The next section of the journey to Jaffa, Palestine, is made on a steamship of the Lloyd Triestino Company, and from there the air station at Ramleh is reached by motor car, the journey then being completed by air. This service provides a cheaper though somewhat slower route from Europe to Iraq than is given by the all-air service.

A sum of £50,000 is to be devoted to the improvement of air communication in Africa, and of this more than £10,000 will be employed for the construction of new landing grounds in Northern and Southern Rhodesia, and for the installation of wireless apparatus. Four new emergency landing grounds are to be constructed under the scheme and improvements are to be effected at 14 other places.

At first the new wireless installations are to be confined to Salisbury and Broken Hill. Immediate steps are being taken to instal a medium wave transmitting wireless station at Salisbury, and it is probable that a special system of directional wireless between Salisbury and Broken Hill will be instituted to enable pilots to cope with the bad weather conditions that often exist along this section.

Atlantic Crossing in a "Puss Moth"

Two transatlantic records were set up a short time ago by Mr. J. A. Mollison, the famous British airman, who flew from Ireland to Nova Scotia in a de Havilland "Puss Moth." These records were for the first westward solo flight across the Atlantic, and for the fastest crossing in that direction. The flight has been claimed to be the first crossing in a light aeroplane, but the "Puss Moth" does not come within the official light aeroplane limits.

Mr. Mollison left Portmarnock, Dublin, on 18th August last, and after crossing the Atlantic was sighted over Halifax, Nova Scotia. He had hoped to reach New York, but after flying on for some time was compelled by dense fog to land in a field at Pennfield Ridge, near St. John, New Brunswick, 30 hr. 10 min. after leaving Ireland. Mr. Mollison had already flown 2,600 miles, and on the following day he covered the remaining 500 miles from St. John to New York.

From Our Readers

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Building Giant Steel Pylons

The accompanying photograph suggests Meccano model-building on a giant scale, but the workmen seen on it are engaged in building a tower or pylon that is to carry wires required for the overhead distribution of current in connection with the "grid" scheme of the Central Electricity Board. The idea behind this scheme is to generate current in selected large central stations, instead of in a larger number of smaller ones owned by Corporations and private companies, and to distribute it at high voltage by means of overhead conductors. It is believed that this plan will make electric light and power cheaper and will encourage their use. Several sections of the "grid" have already been finished and eventually the chain of pylons will spread over the greater part of Great Britain. Many large transformer stations also will be built.

It takes about three days to complete a single pylon, with six men working hard. Then follows the wiring, and in addition, the towers require a coat of aluminium paint. The wires at the top of the tower shown in course of erection in the accompanying photograph are to carry current at 132,000 volts, the largest voltage employed in current transmission in this country.

The man who is working at the highest point on the uncompleted pylon told me that this particular type of tower had been chosen from scores of designs submitted. Although they are of enormous size and strongly built, the pylons undoubtedly are graceful in outline. R. S. JACKSON (Stacksteads).

Building one of the pylons on which the overhead transmission wires of the Grid scheme are supported. Photograph by R. S. Jackson, Stacksteads.

Sydney Harbour Ferries

Until the opening of the Sydney Harbour Bridge last March, the residential districts on the northern side of the waterway were linked to the commercial and industrial southern shore by means of ferries, the only bridges available being far away up the Parramatta River. The ferry boats maintain a splendid service in spite of the great size of the harbour, which is almost completely landlocked and stretches about 20 miles inland. To-day there are two main companies providing services. One of these gives access to the chief places above and below Sydney itself, and the other runs vessels between the city and Manly, a resort 7¼ miles away at the northern extremity of the harbour.

The well-equipped steamers of the two lines provide means of transport for thousands of passengers daily. The chief short service is that between Circular Quay, on the south side of the Harbour, and Milson's Point, where the North Shore electric railway begins, the boats on this service running parallel with the great Bridge. The largest of them are the "*Kuttabul*" and the "*Koompartoo*," sister ships whose names mean "wonderful" and "a fresh start" respectively. These vessels are built of steel and are 209 ft. in length and 45 ft. in width, their draught being 9 ft. Their top speed is 13 knots and they are driven by triple expansion engines, the working pressure being 180 lb. per sq. in.

As is the case with all the Sydney Harbour ferry boats, the "*Kuttabul*" and the "*Koompartoo*" have a screw, rudder and bridge at each end in order to facilitate reversal, and they are painted brown and grey with tall black funnels. They have seating capacity for more than 2,000 passengers, but in the busy hours, when a six minutes' service is maintained, more than this number crowd their decks. They are practically unsinkable, for they have six watertight bulkheads and are provided with 12 long airtight buoyancy tanks.

The boats in which vehicles cross the Harbour are no less remarkable than the passenger vessels. Most of them are built of steel, and except for a narrow strip in the centre, where the funnel and bridge stand, all the deck space is available for motor cars and lorries.

The Manly ferry boats are particularly busy at week-ends, when thousands of people travel to the beautiful beach of that suburb. The trip normally occupies about 40 minutes, the newest boats accomplishing the journey in a shorter time during rush hours, and at one point the vessels run past the opening between the Heads through which rolls the deep sea swell of the Pacific Ocean. The Manly ferry boats are double-ended and double-decked, and are more powerfully built than the boats that ply further up the Harbour, for on stormy days they receive the full blast of the Pacific's fury. Their hulls are

painted green, with brown and white tophamper, and they have white funnels with a black band.

The "*Dee Why*" and the "*Curl Curl*," the largest boats on this service, are 220 ft. in length and 33 ft. in width, their draught being 15 ft. 6 in. They have a top speed of 18 knots and carry 1,600 passengers. They are equipped with engines of 3,000 h.p. These are of the triple expansion type and steam is supplied by four boilers fired with a mixture of tar and volatile oil obtained from the Gas Works. Only two boilers are normally in use, for the boats are rarely called upon for full power and speed.

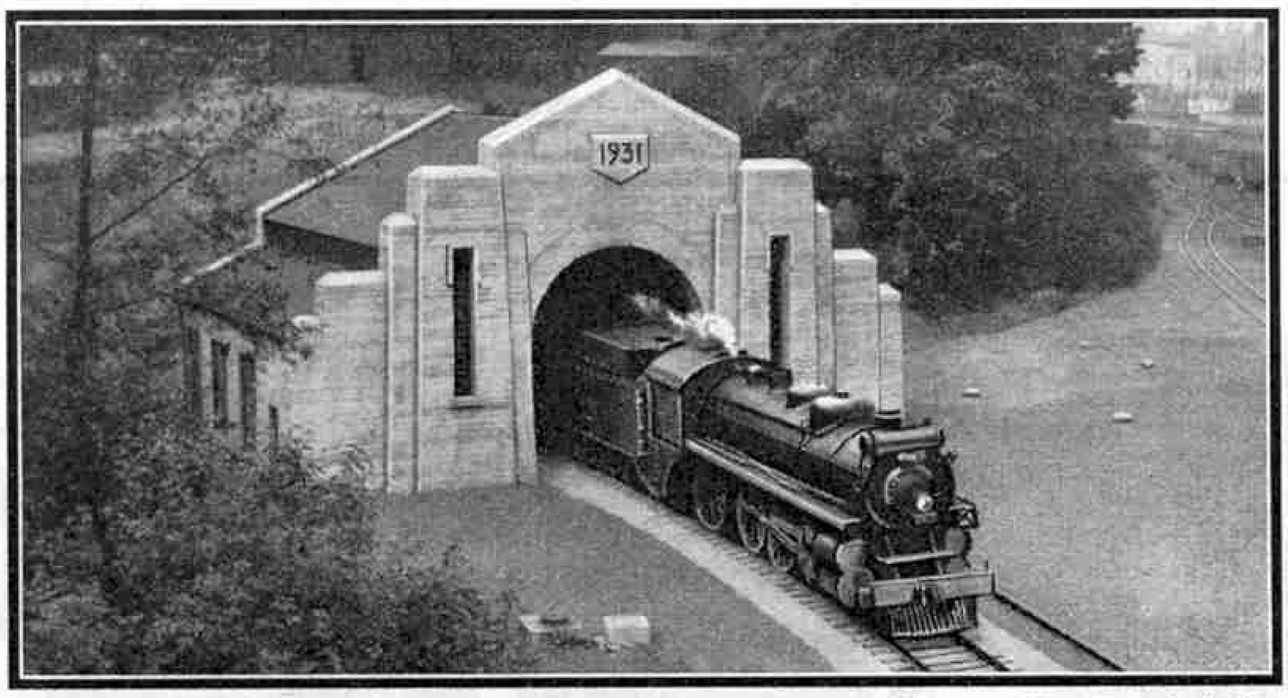
MACLEOD MORGAN
(Cremorne, N.S.W.).

Electric Light from the Winds

At the little station of Hest Bank on the western main line of the L.M.S.R., the winds are harnessed to provide power for lighting purposes. Hest Bank is near the shore of Morecambe Bay, and the land and sea breezes are employed to drive a windmill constructed by Mr. Gardener, a keen engineer of Bolton-le-Sands, who made exhaustive experiments in order to find the most suitable position and the most efficient form of mechanism. The site chosen is not ideal, owing to the proximity of a bank that deflects the wind, but is sufficiently exposed and has the advantage of being near the lamp room at Hest Bank Station, where the storage battery is housed.

The generating plant is erected on a rigid foundation, and the propeller has two blades and is mounted on a casing that is free to revolve on ball bearings. A deflecting wing is provided for the purpose of controlling the speed of the propeller by altering the angle presented to the wind, and the propeller may be stopped in a heavy gale by means of a latch that locks a rudder in position when the wind pressure reaches a certain value. The rudder then keeps the blades in the same plane as the wind. An oil dash-pot is attached to the latch and this makes its action slow in order to prevent the propeller from being stopped by strong gusts of short duration.

The dynamo is attached to the revolving casing and is chain driven. It charges a battery of 12 cells, and these supply current for lighting the platforms, signal boxes and station buildings. The installation has been in use about 10 years and is said to have failed only once, when a prolonged calm put it out of action. The plant was its designer's chief care until his death. Mr. Gardener was a keen inventor and is said to have made experiments with a torpedo of his own design that could be steered electrically. W. T. JONES (Nuneaton).



C.P.R. "Pacific" locomotive No. 2705, of "G.4" class, emerging from the West Portal of the new tunnel under Vancouver. Photograph by W. Hendry, Vancouver.

The C.P.R. Tunnel under Vancouver

The Canadian Pacific Railway terminal at Vancouver is in the Burrard Inlet yard, while the passenger car cleaning and provisioning departments, the repair shops and the roundhouse, or engine shed, that handles all locomotives operating from Vancouver, are in the False Creek yards nearly a mile away. Until recently traffic between the two yards passed over a surface line that crossed seven streets, one of them a main thoroughfare, and at different times during the day and night the passage of long trains of coaches and wagons hauled by busy yard engines or majestic "Pacifics" held up the traffic of the street.

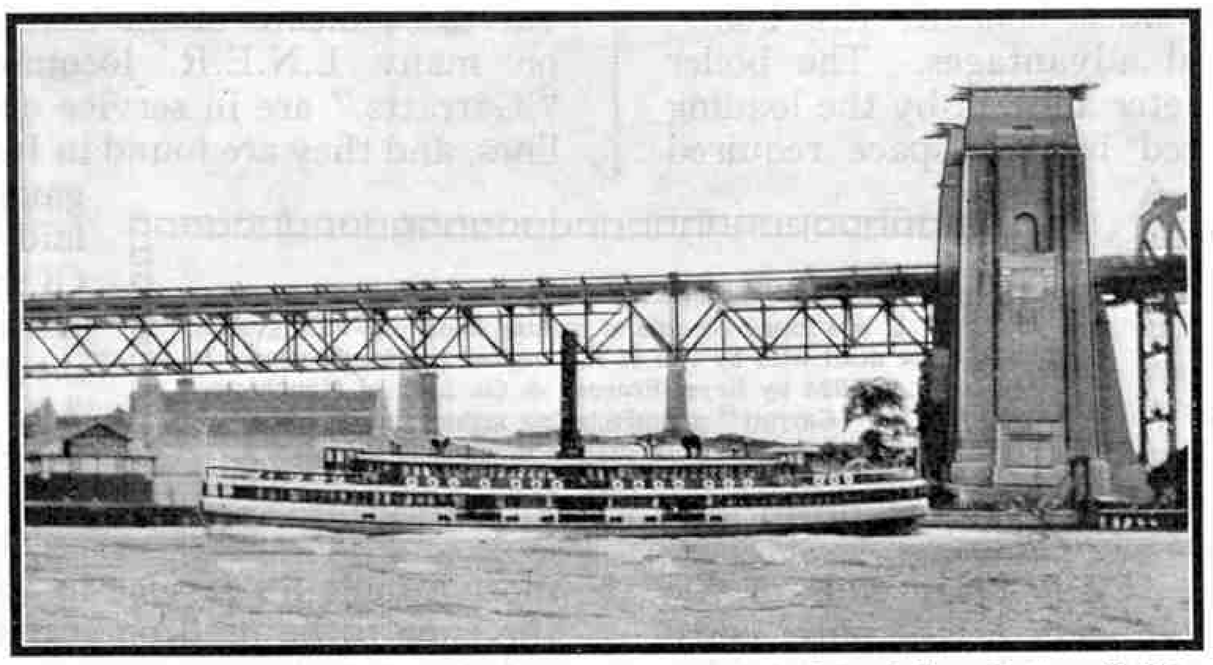
Now the trains burrow underground in order to avoid this disturbance, the Canadian Pacific Railway having recently completed a single track tunnel, 4,600 ft. in length, connecting the two yards. The work of construction began on the Eastern Portal on 1st January, 1931, and the tunnel was opened on 17th January this year.

In plan the tunnel resembles a letter "S," curves at each portal being connected by a straight section that passes many feet under the chief business district of Vancouver. During construction no really hard rock was encountered, the material ranging from earth to sandstone. Heavy timbering therefore was necessary, and the tunnel had to be given a concrete lining 2 ft. in thickness. The bore is 22 ft. 6 in. in height, and 16 ft. in width except on the curves, where the width varies from 17 ft. 6 in. to 19 ft.

The peculiar shape of the tunnel has made it advisable to instal a ventilating system and air is forced through the bore by means of two large fans, one on each side of the track, housed at the West Portal. The fans are driven by two 80 h.p. synchronous motors through magnetic clutches. They are switched on automatically by approaching trains, and remain in operation for five minutes after the section becomes clear in order to ensure that the tunnel is quite clear of smoke before a second train enters it. The system works satisfactorily, the air current blowing at the rate of 10 m.p.h., and ample ventilation would be secured even with one fan out of action.

The track through the tunnel is laid with rails weighing 100 lb. to the yard, placed on creosote sleepers in rock ballast. The entire section is protected by colour light signals of the searchlight type, these now being standard on the C.P.R.

W. HENDRY (Vancouver).

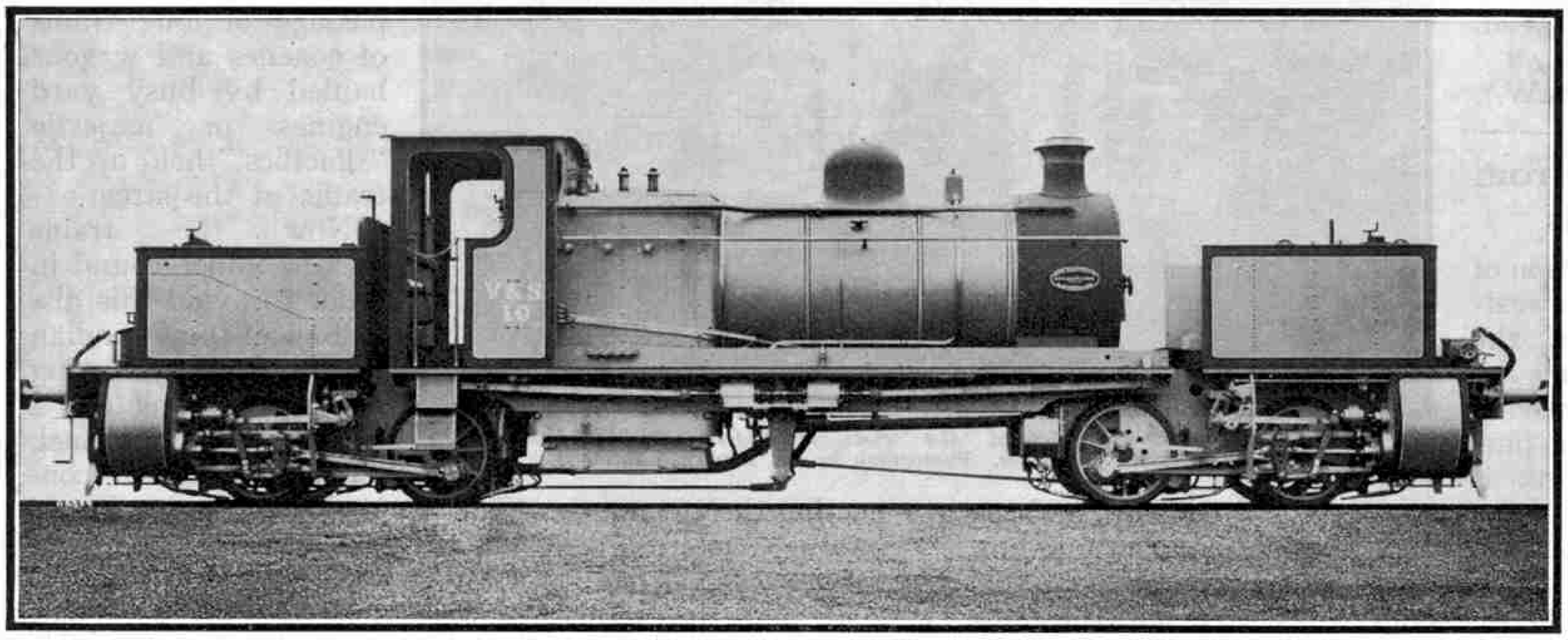


The ferry boat "Koompartoo," passing the southern pylon of the Sydney Harbour Bridge. Photograph by M. Morgan, Cremorne, Sydney.

Flexible Locomotives

II.—The "Garratt" Type and its Developments

LAST month we dealt with the conditions that gave rise to articulated locomotives, and described the "Fairlie," "Mallet" and "Kitson-Meyer" types.



We now come to the well-known "Garratt" locomotive, which is essentially a British production and in use in this country as well as overseas.

Broadly speaking a "Garratt" consists of an ordinary locomotive-type boiler slung between two sets of driving units, over which are placed water tanks and coal bunkers. As there are no axles beneath the boiler, this arrangement has several advantages. The boiler can be of the maximum diameter allowed by the loading gauge, for it is not restricted by the space required for the frames and wheels. A good steaming boiler can therefore be mounted, comparatively short in the barrel, for the efficiency of tubes decreases with their length, of large diameter, and with a wide deep fire-box. The main frames, which carry the boiler, have their points of support close to the inner ends of the bogies, but by placing the cylinders at the outer ends, and by a proper distribution of the fuel bunker and tanks, a satisfactory adjustment of weight is obtained. This type of articulated locomotive is greatly favoured throughout the British Empire, and appears to be particularly successful in working on narrow gauge lines. It is capable of traversing the most difficult curves with perfect ease, owing to its weight being slung between the two motor bogies, in much the same manner as the load is carried by a "crocodile" wagon.

The "Garratt" locomotive owes its inception to the British engineer after whom it is named. The first one was built for a Tasmanian railway in 1909, and since that time the use of such engines has spread rapidly on railways of all gauges. Particularly notable are those on the 3 ft. 6 in. gauge South African Railways. Some have the 4–8–2 : 2–8–4 wheel arrangement, or "double Mountain" as it might be called. Weighing over 214 tons in working order these engines develop a tractive effort of 78,650 lb. at 75 per cent. working pressure, and they regularly haul loads of 1,000 tons over gradients as severe as 1 in 66. They were built by Beyer-Peacock & Co. Ltd., of Manchester, who hold the "Garratt" manufacturing rights, and are the most powerful engines ever built outside the American Continent.

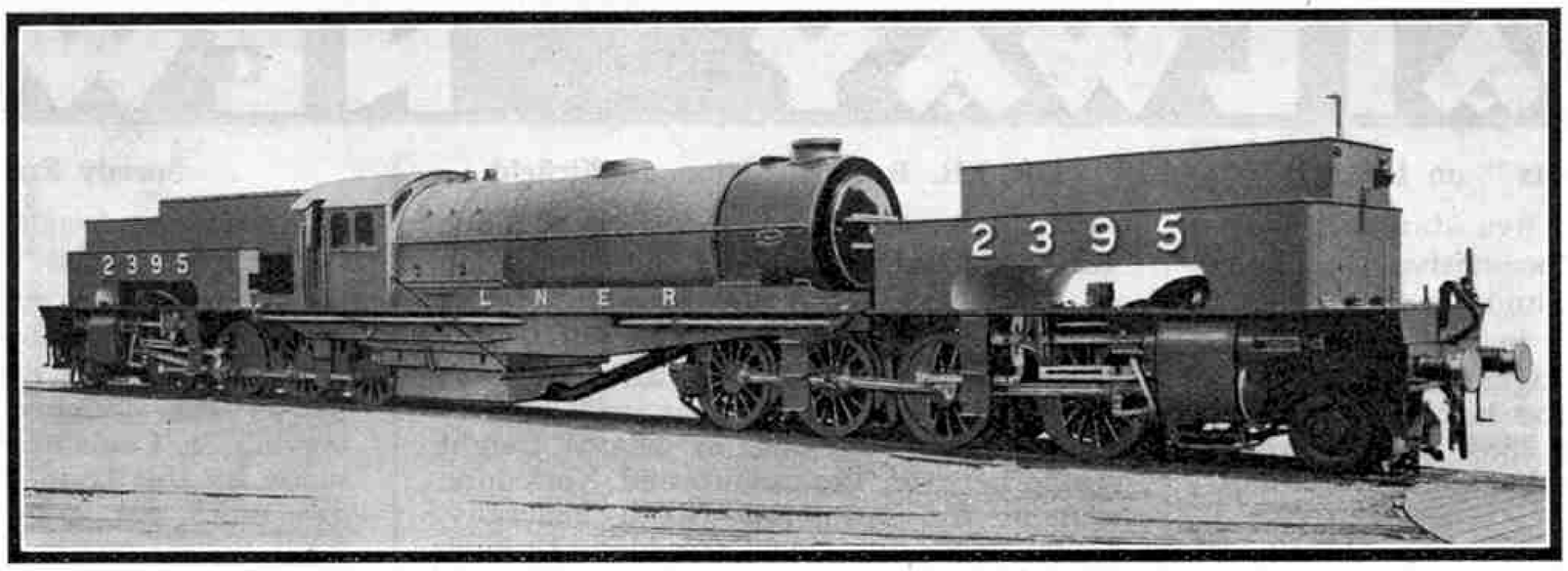
There are some fine "Garratt" express locomotives in New Zealand, and these were illustrated and described in the *"M.M."* for March 1930. They are notable for having three cylinders in each driving unit, and two sets of outside Walschaerts valve gear, operating all three valves by means of the Gresley system of levers, as used on many L.N.E.R. locomotives. In South America "Garratts" are in service on metre and standard gauge lines, and they are found in India on the broad or 5 ft. 6 in. gauge, and also on other systems laid with narrow gauge tracks. Of the last named, the Darjeeling Himalayan Railway is of special interest, for the line is of 2 ft. 6 in. gauge and is sharply curved and graded throughout its length of 51 miles.

The first "Garratt" locomotive constructed for service in Great Britain. It was found capable of hauling loads one-third greater than those dealt with by two of the engines previously used. It was built in 1924 by Beyer-Peacock & Co. Ltd., of Manchester, who hold the "Garratt" manufacturing rights and to whom we are indebted for the photographs illustrating this article.

The first "Garratt" locomotive built for service in England was also the first of the type to be used on standard gauge lines. This was not for a railway company, but for service about the Hafod Copper works of Vivian & Sons Ltd., of Swansea. The works are situated in a valley, and connected with the G.W.R. and the canal, both of these being at a higher level. The gradient is 1 in 20, and the line is sharply graded at the actual connection with the G.W.R. system, where the radius is 97 ft. The "Garratt" locomotive showed itself capable of dealing successfully with these difficulties, and at the same time its coal consumption was found to be some 25 per cent. less than that of two standard shunting tank engines working together, and this with loads 33⅓ per cent. greater.

Considerable interest was aroused in 1925 at the Stockton and Darlington Railway centenary celebrations at Darlington when a "Garratt" locomotive

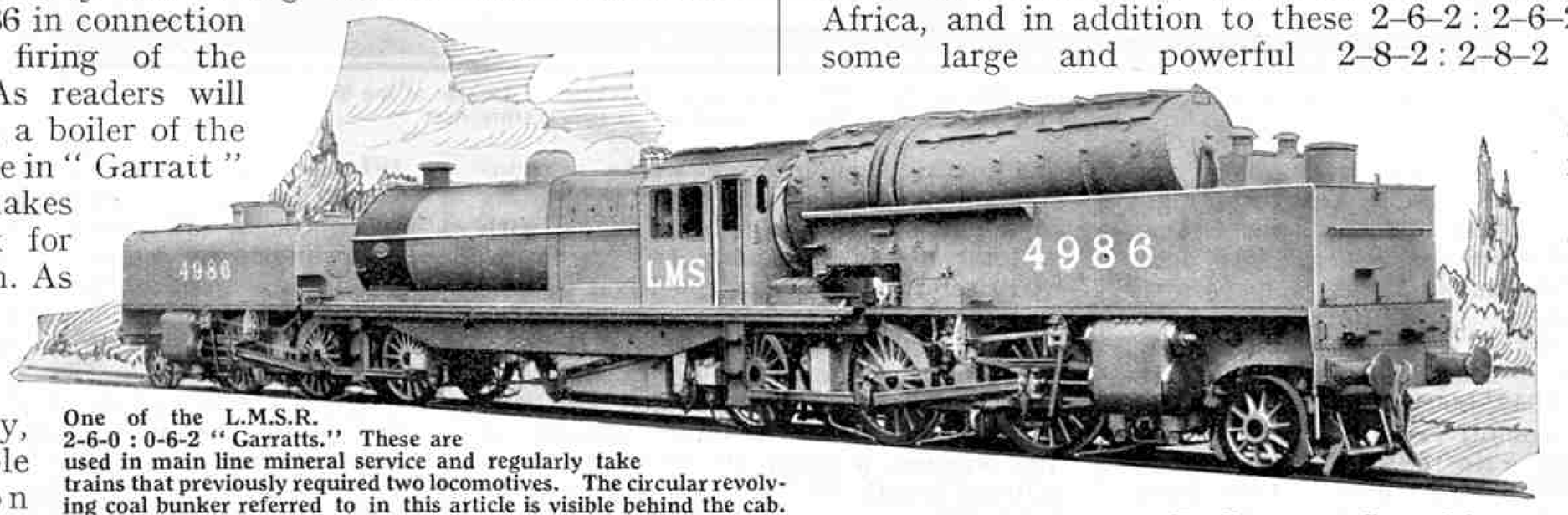
built for the L.N.E.R. made its first public appearance. This engine, the now well-known No. 2395, has the 2–8–0 : 0–8–2 wheel arrangement, and is equal in capacity to two of the L.N.E.R. three-cylinder "Consolidation" mineral engines. Each engine unit has three cylinders, and following Mr. Gresley's usual plan, two sets of outside Walschaerts gear actuate the three valves. The cylinders and motion are standard with those of the 2–8–0 locomotives previously mentioned, and where possible the details are interchangeable with that class. The boiler is comparatively enormous, and its size is only made possible by the fact that the locomotive is built upon the "Garratt" system. It has a diameter of 7 ft., and a total heating surface of 3,640 sq. ft. With its tractive effort of 72,940 lb. at 85 per cent. working pressure, and its weight of 168 tons, it is the largest, heaviest and most powerful locomotive in Great Britain. Its duties are to bank heavy coal trains on the Worsborough branch between Wath and Penistone, where two successive miles are inclined at 1 in 40.



L.N.E.R. No. 2395, the first "Garratt" locomotive built for a railway company in Great Britain. It has six cylinders and 16 driving wheels, and is the largest, heaviest and most powerful locomotive in the British Isles.

Some two years afterwards the L.M.S.R. took delivery from Messrs. Beyer-Peacock of three engines of the 2–6–0 : 0–6–2 type. After some experience with these between Toton and Cricklewood on coal trains that previously required the services of two locomotives, 30 more of the type were ordered and were delivered in 1930. These are Nos. 4967 to 4996, the earlier engines being 4997–99.

An extremely interesting feature was introduced on No. 4986 in connection with the firing of the engine. As readers will appreciate, a boiler of the size possible in "Garratt" designs makes hard work for the fireman. As a large fuel capacity is necessary, considerable attention has to be given to trimming the coal down to the shovel plate, with the result that the fire may be neglected to some extent, and moreover this trimming involves extremely hard work. In order to render this extra work unnecessary engine No. 4986 was fitted with the Beyer-Peacock patent self-trimming bunker. The coal is carried in a closed container, which has opening doors on top to allow of coaling. This container is circular in form and becomes wider towards the cab end. It is pivoted so that the top side is practically horizontal, and thus the lower side of the bunker is well sloped. The bunker is revolved periodically by a small steam engine driven from the boiler of the locomotive, and in this manner, owing to the shape and inclination of the container, the coal is caused to slide forward. The bunker may thus be revolved between periods of firing, and no labour in the matter of trimming the coal is called for on the part of the fireman. The fact that the container can be completely closed prevents dust from being blown into the cab, particularly when the engine is running bunker first; and owing to its circular form the look-out when running in this direction is improved. This scheme was so successful that the other engines of the class have been similarly provided.

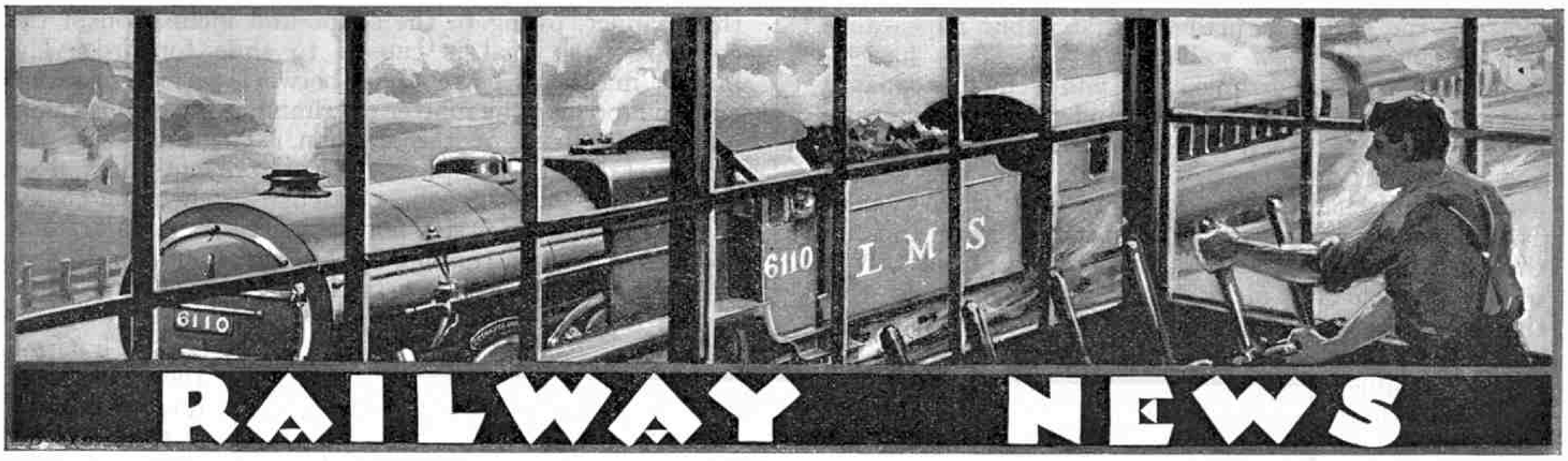


One of the L.M.S.R. 2-6-0 : 0-6-2 "Garratts." These are used in main line mineral service and regularly take trains that previously required two locomotives. The circular revolving coal bunker referred to in this article is visible behind the cab.

Although these engines do not rank as a standard design of the L.M.S.R., the opportunity has been taken of making as many parts of them as possible interchangeable with those of other engines. Thus the cylinders and motion and other features are similar to those employed on the familiar "Moguls." A tractive effort of 45,620 lb. is exerted by these "Garratts" at 85 per cent. working pressure, and their original weight was 148 tons 15 cwt., though with the patent bunker they are slightly heavier, 152 tons 10 cwt.

The success attained by "Garratt" locomotives has given rise to what are known as modified "Fairlie" locomotives with single boilers. In these the boiler and tanks are carried on a girder frame as in the "Garratt" system, but the driving units are each pivoted at the centre of the rigid wheelbase. This system reduces the wear between the flanges and the rails. Locomotives of this kind are in use in South Africa, and in addition to these 2–6–2 : 2–6–2 engines, some large and powerful 2–8–2 : 2–8–2 modified "Fairlies" are also in use.

A later development is the "Garratt-Union" type, which is found on the South African Railways. In this type certain characteristics are found both of the "Garratt" design and of the modified "Fairlie." The water tank at the front end is carried on the forward motor bogie unit and therefore swivels with it, but the boiler, cab and rear bunker are all mounted upon a common girder frame. Thus the bunker does not move relative to the cab, but the rear bogie swings under it. This rigid bunker is of course very favourable to the installation of a mechanical stoker, which is provided. Both "double Prairie" and "double Pacific" locomotives are in use, the latter working expresses between Capetown and Pietermaritzburg, which is a severely graded and sharply curved line.



More "Baby Scots" on L.M.S.R.

The new batch of five standard 4–4–0 compound express locomotives has been completed at Derby and the last three—numbered 937-9—are in traffic. A batch of ten 2–6–4 tank engines has also been finished at Derby, the last to be turned out being numbered 2384. Derby works are now building a further series of standard 2–6–2 tank engines.

A 2–6–2 tank engine—No. 15550—is working on the suburban passenger services between London (Broad Street) and Potters Bar, Barnet, and other places on the L.N.E.R. line. The ancient North London trains that have so long survived on these routes are at last being replaced by new trains composed of comfortable up-to-date stock.

Eight more of the "Royal Scot" express locomotives are being named after famous Territorial regiments. No. 6162, bearing the name "*Queen's Westminster Rifles*," has been noted at Camden.

Some further "Claughtons" have been reconstructed at Crewe and are now running as "Baby Scots." They are Nos. 5936, 5942, 6005 and 6012. Several L.M.S.R. locomotives—including the two "Claughtons," No. 5912, "*Lord Faber*," and No. 5975, "*Talisman*"—have been fitted with chimneys of enlarged diameter in conjunction with new blast-pipes of the "Kylala" type, which has two shaped "petticoats" in the smoke-box. These give a softer, but ringing note to the exhaust.

Among the engines lately withdrawn for scrapping are two "Experiments," Nos. 5454, "*Sarmatian*," and 5520, "*Sisyphus*."

Skylights on "Met" Carriages

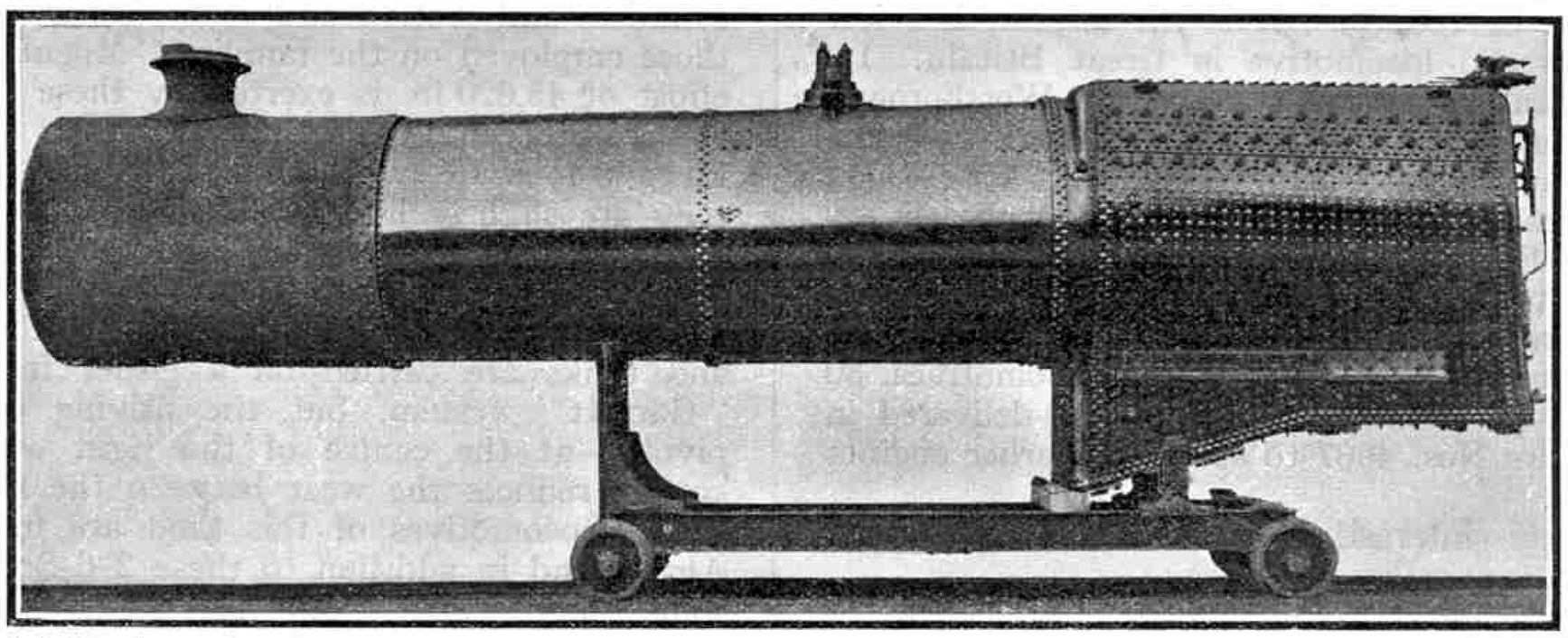
Two carriages on the Metropolitan Railway have been fitted experimentally with skylights in the roof of each compartment in order to secure better lighting, especially when a train is in a station. They are running between London and Uxbridge and on the Rickmansworth and Watford service.

L.M.S.R. Reconstruction at Mirfield

With the opening of a new marshalling yard for freight trains and the elimination of a "bottleneck" three-quarters of a mile long at Mirfield (Yorkshire), the L.M.S.R. have completed an important reconstruction scheme that will greatly improve the working of heavy freight traffic between Lancashire and Yorkshire, and in the industrial North generally. Four lines are now provided through Mirfield instead of two, and the widening has involved engineering works of considerable magnitude, including the building of a viaduct of seven girder spans, with a total length of about 170 yards, to carry the railway across the River Calder, a mill "goit" and three roads, near Mirfield station.

To improve the working of goods trains there have also been provided two new arrival lines with a total capacity of 120 wagons, a group of 12 sidings with a total length of 2½ miles, sufficient to hold 620 wagons, and a new wagon repairing depot. Water for locomotives is obtained from a new artesian well and a new pump house has been built to feed two concrete tanks of 20,000 and 4,000 gallons capacity respectively.

A feature of the Mirfield improvement scheme is the installation for the first time in this country of the new electric "speed" signals. These are of the multiple-aspect colour-light pattern. In addition to the usual indications, colour-lights are provided at junctions and these not only tell the driver whether it is safe to proceed but also how fast he may go and on which route. The results obtained will be awaited with interest.



A G.W.R. locomotive boiler ready for mounting on the frames, showing the brackets, at the side of the fire-box, on which the rear end of the boiler slides when it expands as its temperature rises.

Speedy Freight Trains

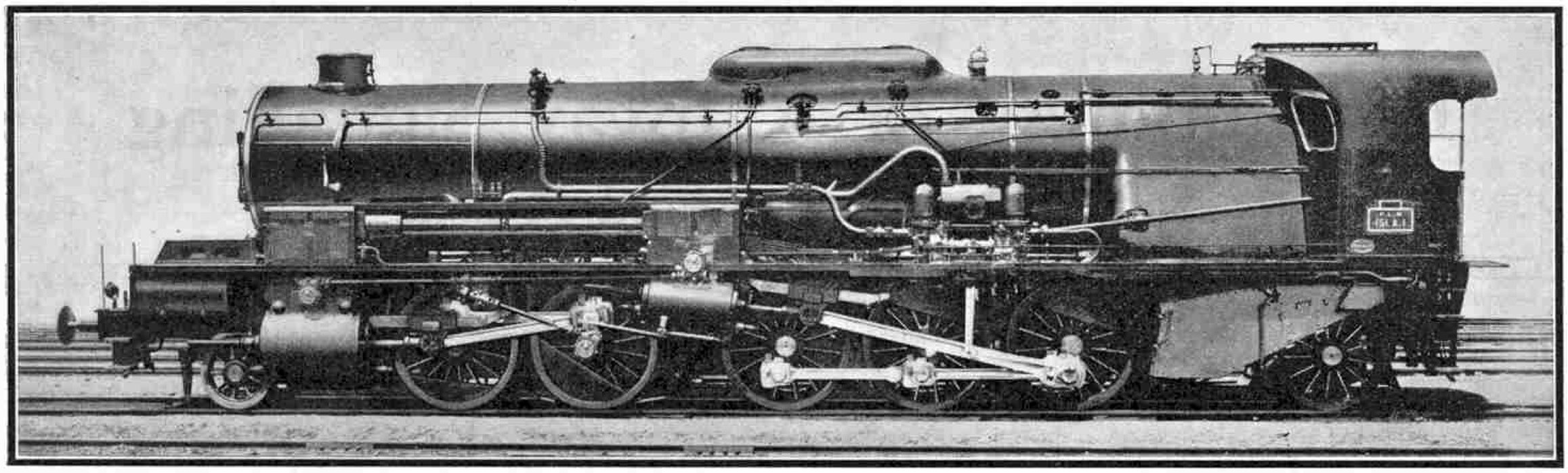
The fastest freight train in America is "*The Blue Streak*." It runs southward at an average speed of 31 m.p.h. over a distance of 590 miles on the St. Louis and Southwestern Railroad, often referred to as the "*Cotton Belt*" line. After leaving St. Louis at 6.0 p.m., 10 stops are made by this train, the last at Lewisville, 528 miles out, where it is divided, one part going on to Texarkana and the second to Shreveport, where deliveries are made on the day after departure from St. Louis. The average speeds of the two sections are 31.4 m.p.h. and 31.3 m.p.h. respectively.

The longest non-stop British freight train is the L.M.S.R. 7.45 p.m. goods express from Camden to Edge Hill, Liverpool, a distance of 191 miles. This train reaches its destination at 12.39 a.m., its average start-to-stop speed being 39 m.p.h., a remarkable performance for a heavy train.

Another speedy British freight train is the 3.40 p.m. Glasgow Goods of the L.N.E.R. This covers the 436 miles between King's Cross (Goods) and Glasgow (High St.) at an average speed of 32.5 m.p.h. Six stops are made, and the longest non-stop run is the 111.7 miles from Peterborough (North) to Severus Junction, York, the average speed for this section being as high as 43.8 m.p.h.

Electrification of L.M.S.R. Line

An important addition has been made to the electric railways in the London area by the recent opening of the electrified section of the Tilbury line between Barking and Upminster. The mileage of this section is 7¾ miles and includes the stations of Upney, Becontree, Heathway, Dagenham and Upminster. Upney and Heathway are new stations; the others have been enlarged and brought up to date. At Barking the line connects with the District Railway from Bow, and through trains are now operating from the District line to Upminster.



2-10-2 Locomotive for French Railway

Several new locomotive designs have been introduced in recent months on French railways, the most striking being a very powerful 2–10–2 freight locomotive that has been built to the designs of Monsieur R. Vallantin for the Paris, Lyons and Mediterranean Railway. It embodies a number of distinctly novel features, as may be seen in the photograph reproduced on this page. At first sight it would seem to be built on the articulated principle, but actually the frames are rigid throughout, the locomotive being a four-cylinder compound with all the cylinders outside the frames. The two low-pressure cylinders, which have a diameter of 29 $\frac{5}{16}$ in. and a stroke of 27 $\frac{9}{16}$ in., occupy the normal positions and drive a group of four wheels that are coupled together with outside rods in the usual manner. The high-pressure cylinders of 18 $\frac{7}{8}$ in. diameter and 25 $\frac{9}{16}$ in. stroke, are placed midway along the frames and drive a group of six coupled wheels. A pair of inside coupling rods link the second and third coupled axles, which are cranked, with the result that the two groups, comprising altogether 10 wheels, are coupled together and the two sets of cylinders and motion synchronise in operation.

The coupled wheels are 4 ft. 11 $\frac{1}{16}$ in. in diameter. The boiler has a total heating surface of 3,661 sq. ft.; the grate area is 54 sq. ft.; and the working pressure is 290 lb. per sq. in. Rotary cam poppet valves and gear are employed. The tractive effort is 65,961 lb. and the calculated horse-power 2,820, which will enable good work to be done on the difficult Bourbonnaise division.

The engine weighs in full working order just over 120 tons; its tender, which runs on two four-wheeled bogies, has a capacity of 6,160 gallons of water and nearly seven tons of coal, and weighs (full) 61 tons 10 cwt.

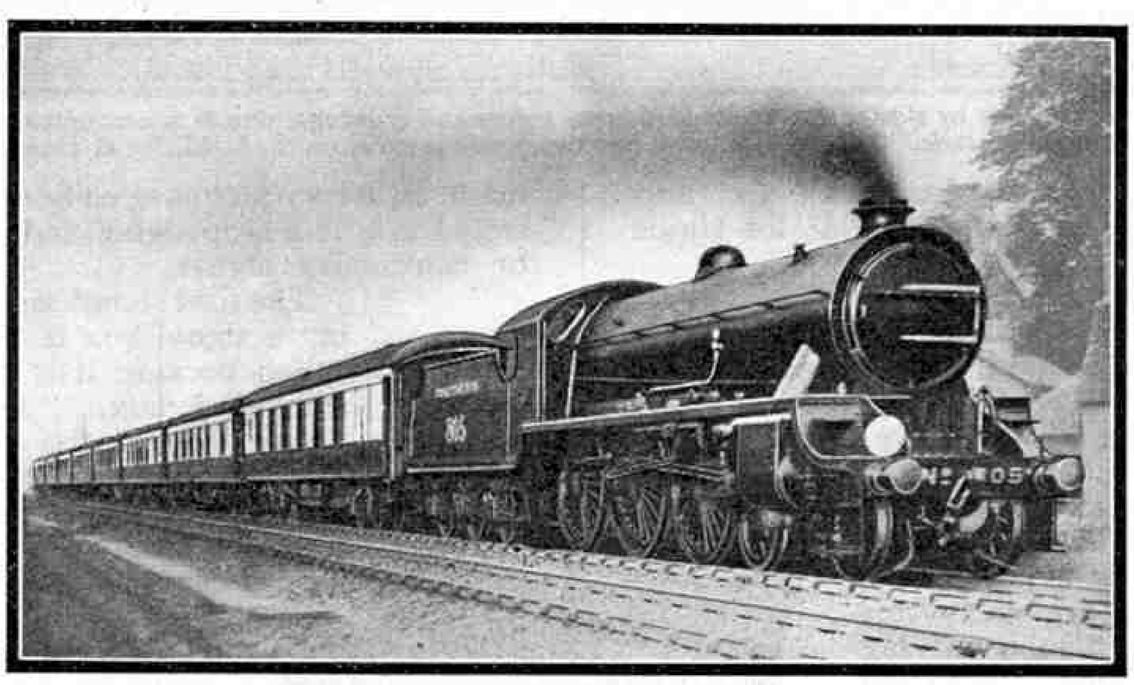
Felt Pad Lubrication on G.W.R. Engines

The new method of lubricating coupling and connecting rods with felt pads, instead of using worsted trimmings, has been tested for more than a year with pronounced success. It is now being applied to axle-boxes and piston cross-heads and promises to be equally effective. The saving in oil is very marked and the reduction in wear and tear is considerable.

New L.N.E.R. Marshalling Yard

A new freight marshalling yard is being constructed by the L.N.E.R. between Mottram and Dinting on the Penistone and Manchester section of the former Great Central line. The new yard will operate by means of gravity and will have eight reception sidings, with a capacity of 80 wagons each, and 20 marshalling sidings capable of taking 65 wagons each. When it is finished and brought into use it will greatly facilitate the working of the heavy freight traffic that passes from east to west and vice versa through the Woodhead tunnel. This tunnel is on the L.N.E.R. main line from Sheffield to Manchester, and is 3 m. 13 yds. in length.

The making of the yard has required some heavy excavation work. About 1 $\frac{1}{4}$ million cubic yards of earth have been moved, and nearly half of this has been used in making embankments.



The upper illustration shows one of the new 2-10-2 compound locomotives of the Paris, Lyons and Mediterranean Railway described on this page. It is reproduced by courtesy of the P.L.M.R. In the lower picture the "Southern Belle," hauled by 4-6-0 locomotive No. 805, "Sir Constantine," is seen passing Star Lane. (Photograph, Railway Photographs, Liverpool.)

S.R. Locomotive News

Ashford works are engaged on an order for five standard 2–6–0 "Moguls" of the N class, having two cylinders of 19 in. diameter and 28 in. stroke, and 5 ft. 6 in. driving wheels. Nos. 1400 and 1401 are already in service. They have the new type of tender with the upper part of the side plates sloping inwards.

The strengthening of the bridges and permanent way on the Kent Coast line has now been completed and the 4–6–0 locomotives of the "Lord Nelson" and "King Arthur" classes are permitted to work on the services from London to Margate and Ramsgate via Faversham.

L.N.E.R. (G.E.) 4-6-0 Engines Rebuilt

The 15 three-cylinder express locomotives of the 4–4–0 "Hunts" series have been completed at Darlington and are in traffic. A full list of their numbers and names was given on page 518 of the *"M.M."* for July last. Two more 0–6–0 freight engines of the J39 class have been turned out and are numbered 1453 and 1471.

Two of the Great Eastern 4–6–0 express locomotives—Nos. 8576 and 8579—have been rebuilt with larger boilers. A correspondent who saw No. 8579 at Liverpool Street recently, describes it as having a smart and pleasing appearance. The new boiler has a barrel of larger diameter than the former one and the fire-box is round-topped and flush with the barrel. The total heating surface is 1,935 sq. ft., the grate area is 30.5 sq. ft., and the working pressure 180 lb. per sq. in. The chimney and other details are of standard "Gresley" patterns.

Speeding up on Canadian National Railways

Faster running for the "*Continental Limited*," operating daily between Montreal and Vancouver, is announced by the Canadian National Railways. The distance between these points is 2,929 miles and the new timing allows 89 hours 25 minutes, cutting off 6 hours 25 minutes from the previous running time and making this the fastest schedule that has ever been operated across Canada by the Canadian National Railways. While the speed per hour may not appear remarkable to British travellers, the operating time is actually fast, involving speeds up to 70 miles an hour.

These trains operate a minimum of eight coaches, weighing approximately 600 tons, and at busy travel periods additional coaches are required. They are hauled by locomotives of the "6100," "Northern Type," a special 4–8–4 design evolved by Canadian National engineers. Each of these engines weighs 300 tons and between Winnipeg and Edmonton, 802 miles, only one is used, with no intermediate changes.

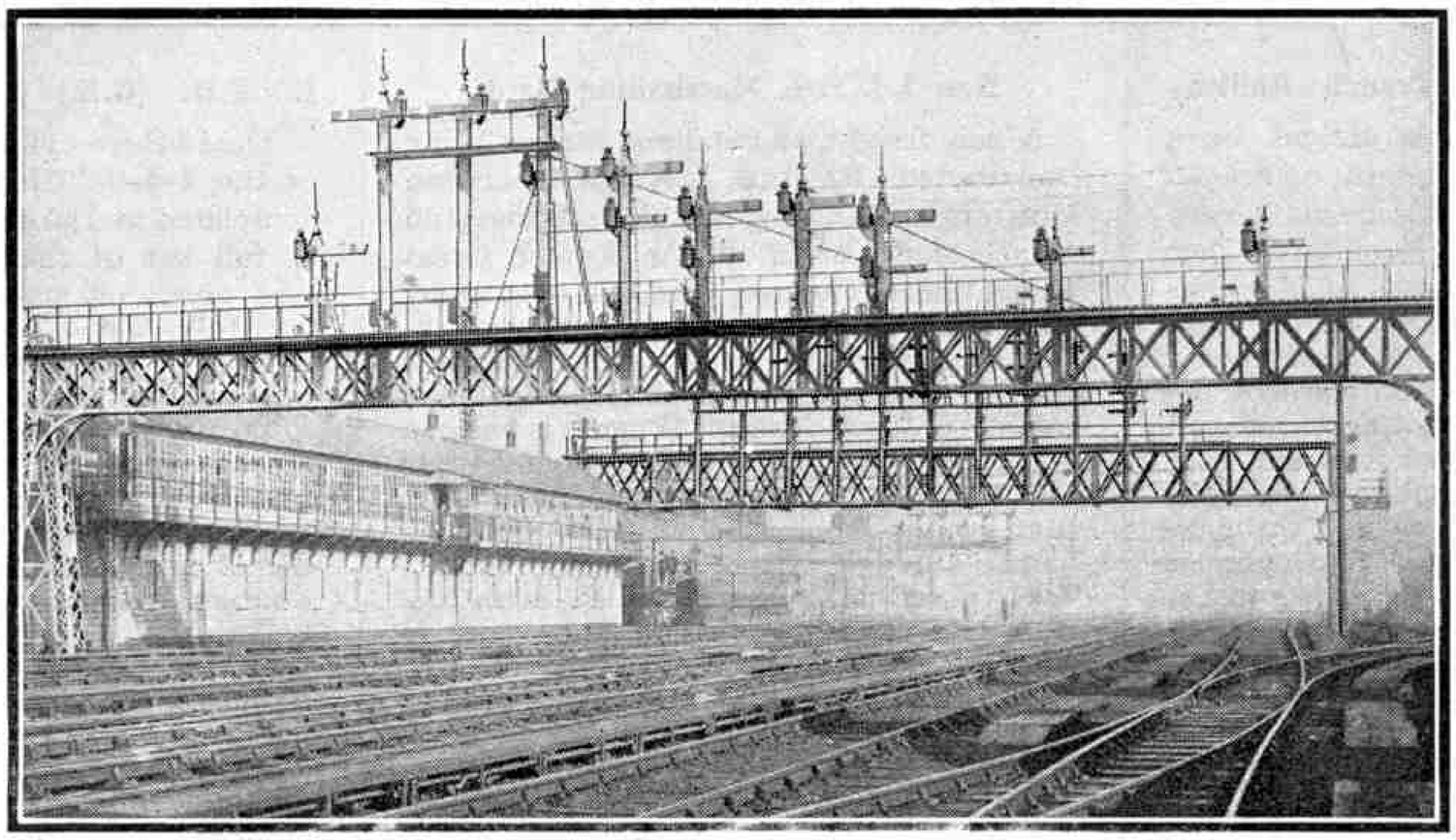
The "*Continental Limited*" leaving Montreal on Monday evening reaches Winnipeg Wednesday morning, Saskatoon Wednesday night and Edmonton Thursday morning. It then crosses the Rockies and runs along the canyons of the Thompson and Fraser rivers to arrive at Vancouver early on Friday morning.

Development of Railway Signalling

Safety Devices, Past and Present

THE great railways of to-day are provided with a wonderfully complete system of safety devices that make travelling by rail, even at the highest speeds, as free from danger as human ingenuity can secure. Signalling methods have reached a very remarkable degree of perfection and trains are shepherded from starting point to destination with unceasing watchfulness.

Signal boxes are placed at various points along the line, and from them the signals and points are operated by specially trained signalmen. As everyone knows, the signals themselves are in the form of semaphore arms fixed on high posts by the side of the line. These signal posts are usually placed at the left-hand side of the line of rails to which they refer, and the signal arms are on the left-hand side of the posts as seen by the driver of an oncoming train. There are thus separate sets of signals for both "up" and "down" lines, the "up" line being as a rule the line for trains going towards London.



Where many lines run side by side and there are numerous points and crossings, signals are mounted upon a gantry spanning the track. This illustration shows two good examples on the L.N.E.R., at York.

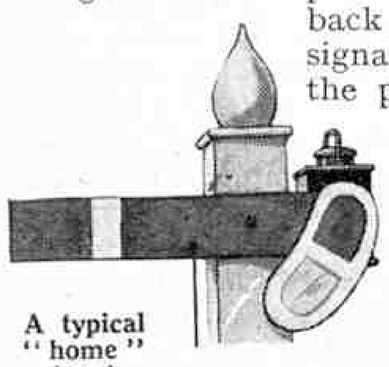
The front of the signal arms, that is the side seen by the engine driver, is painted red with a white stripe, and the back is painted white with a black stripe. Each signal post is also fitted with a lamp that is kept burning continuously, requiring to be replenished with oil only about once a week. Coloured glasses, called "spectacles," are attached to the signal arms, and through these the engine driver views the light at night.

The normal position of a signal arm is horizontal, signifying "danger," and when the arm is in this position a red glass covers the light, also signifying danger. The "line clear," or "all right," indication is given by lowering the arm to an angle of about 60 degrees, and in this position a green or blue glass is in front of the light.

At one time a white light was used for this purpose, but its use proved to be dangerous. Drivers found it extremely difficult to decide whether a particular light was their signal or not, and there was always the possibility of a light in the window of a house close to the line being mistaken for a signal, with possibly disastrous consequences. Yet another danger was always present, namely, that a red "spectacle" glass might be broken, with the result that a white "line clear" signal might be given while the signal arm was actually at "danger."

Tapper bell used by signalmen to communicate with each other by means of a code of rings.

Signals are also provided with a small white light showing at the back which is obscured by a mask when the signal is lowered. These "back-lights" are for the purpose of enabling the signalman to tell at night whether the lamps of his signals are burning and also whether the signal arms are working correctly, in cases where his signals are in such positions that he cannot see the red and green lights.



A typical "home" signal.

As we have already seen, the normal position of a signal arm is at danger, and the arm is balanced in this position by the spectacle portion and by a weighted lever placed close to the foot of the post. Connection between the lever and the arm is made by means of an iron rod. Should the rod break—which is unlikely—the weight of the spectacle would prevent the arm from falling to the "clear" position. Before the arm can be lowered the weighted end of the lever must be raised, and this is done by the movement of a lever in the signal box, which pulls a wire connected to a chain attached to the weighted lever at the opposite end to the weight. If the chain or the wire should break while the signal is in the "all right" position, the weight on the lever will automatically raise the arm, thus preventing the possibility of the signal continuing to show "all right" if the signalman does not notice the breakage.

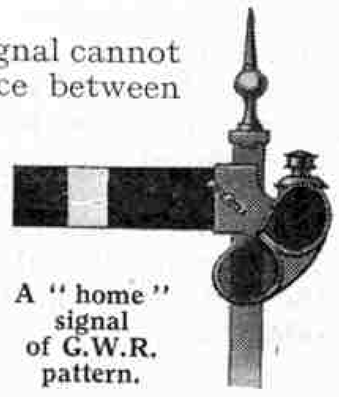
Signal arms are made either with square ends or "fish-tailed" ends. The square-ended arm is a stop signal and the fish-tailed arm is a "distant" or cautionary signal.

The first signal seen by the driver of a train approaching a signal box is the fish-tailed "distant" signal, so called because it is the signal at the furthest distance from the box. "Distant" signals were introduced about 1846 as the result of the increased weight and speed of trains, which made it difficult for a driver to pull up quickly at a "stop" signal, on account of not receiving sufficient warning. The object of the "distant" signal is to warn the driver when the next or "home" signal is likely to be at danger, and thus give him time to reduce the speed of his train to be ready to stop at the "home" signal if necessary.

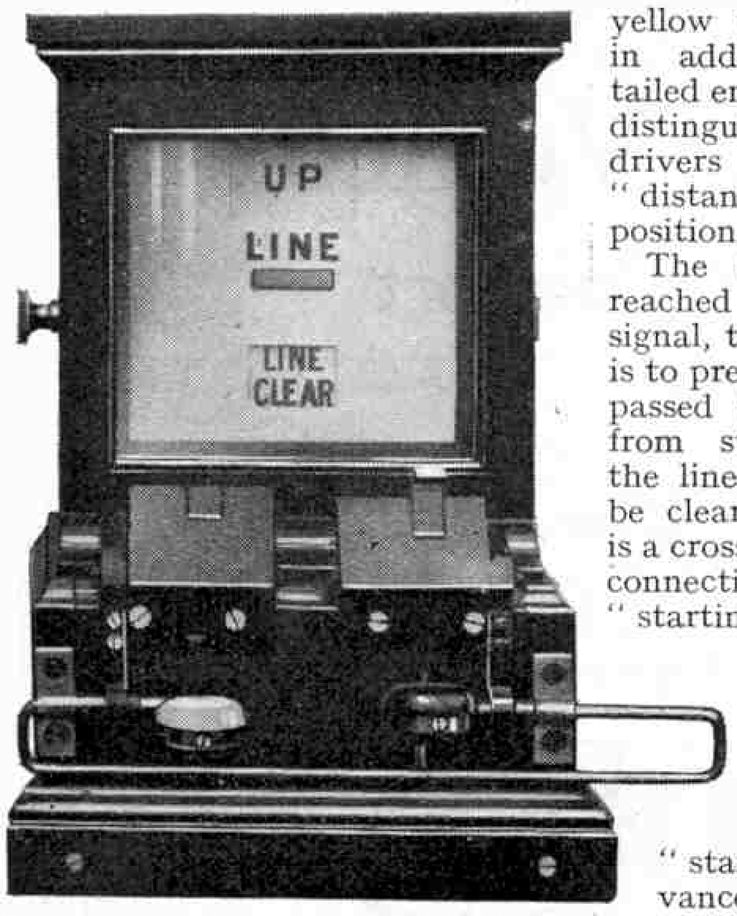
As a train is likely to be travelling at a high speed when the driver first sees the "distant" signal, it is clearly necessary that this signal should be sufficiently far in advance of the "home" signal to allow the driver to pull up at the latter if required. The standard distances from "distant" to "home" vary from 600 yds. on a rising gradient to 1,000 yds. on a falling gradient.

As long as a "home" signal is at danger the preceding "distant" signal also is kept at "danger" and the driver slows down and proceeds cautiously towards the "home" signal. If the latter is at "danger" when he reaches it, he must stop dead and must on no account go on until the signal is lowered to the "all right" position.

At night the fish-tail shape of a "distant" signal cannot be seen, and formerly there was no difference between the red light of a "distant" signal and that of a "stop" signal. It is becoming more general practice, however, to use an orange light to indicate the danger position on distant signals and in some cases a special arrangement is in use whereby an illuminated fish-tail is indicated at the side of the lamp. Similarly, to aid in its identification by day, the arm is painted



A "home" signal of G.W.R. pattern.



The key disc instrument used by the signalman to indicate the state of the line.

yellow with a black stripe in addition to the fish-tailed end. Apart from such distinguishing features the drivers usually know the "distant" signals by their position.

The third signal to be reached is the "starting" signal, the function of which is to prevent a train that has passed the "home" signal from starting away until the line ahead is known to be clear. Sometimes there is a crossover road or a siding connection ahead of the "starting" signal. In such cases a fourth signal is necessary and this is called an "advanced-starting" signal. The shape of "starting" and "advanced-starting" signals is similar to that of "home" signals.

Sometimes signal boxes are not far enough apart to allow the "distant" signal to be placed at the standard distance from the "home" signal, and where that is the case the "distant" is placed on the same post as the "advanced-starting," "starting" or "home" signal of the previous box, its position always being below the other signal.

Junctions are usually protected by two "distant" and two "home" signals. The two signal arms are arranged on a "bracket," the left-hand and right-hand arms applying respectively to trains proceeding to the left or to the right at the junction. One of the arms is generally placed higher than the other, the higher arm applying to the more important line.

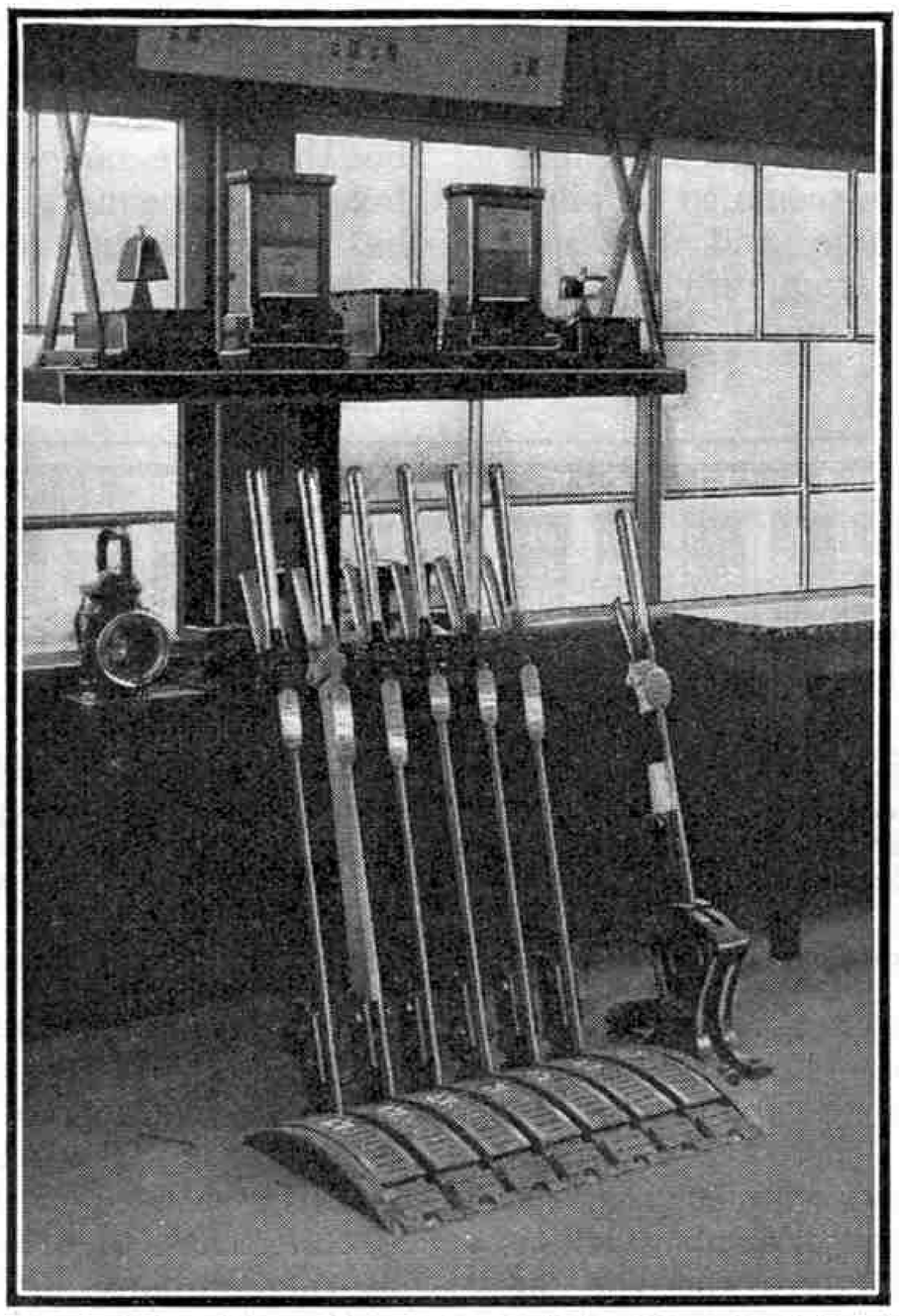
In addition to the signals already described there are many others employed for special purposes, such as shunting, backing, etc.

The approaches to and the exits from important stations present a bewildering array of lines, points and crossings, and at such places sets of signals are often carried over the rails on a sort of bridge called a "gantry."

Every signal box is electrically connected with the box on each side of it, and is provided with telegraph and bell instruments. Trains are worked on what is called the "block" system. The length of line between the last stop signal of one box—that is the "starting" or the "advanced-starting" signal—and the first stop signal of the next box—that is the "home" signal—is called a "block" section, and only one train at a time is allowed to be on each section.

Each box has a tapper bell for each section on each side of it, both for "up" and "down" lines, and communications between signalmen are made chiefly by means of a code of bell signals.

Let us suppose that a train is at a certain signal box, which we will call No. 1, ready to commence its journey. The signalman in this box calls the attention of the signalman in No. 2 box by signalling one beat on the bell in the latter's box. The man in No. 2 box acknowledges this signal by repeating it, so that one beat sounds on the bell in No. 1 box. Signalman No. 1 then signals four consecutive beats on the bell in No. 2 box, which in the railway code means "Is line clear for an express passenger train?" The signalman in No. 2 box, after making certain that the line is clear for a quarter of a mile inside his "home" signal—that is as far as his "clearing point"—repeats the four beats, thus indicating "line clear" to the man in No. 1 box.



A general view of the equipment of a small signal box. The bell and disc instruments are on the shelf above the levers while the diagram shows the layout of the section controlled.

At the same time signalman No. 2 brings into use his key-disc instrument. This is a box-shaped apparatus having three positions—"line clear," "line blocked," that is the normal position, and "train on line." In this case signalman No. 2 pegs his instrument to show "line clear" and so causes the "line clear" indication to appear on a similar but keyless instrument on box No. 1. This gives signalman No. 1 permission to send forward the train and he lowers his "starting signal" and his "advanced starting signal" if there is one, and the train moves forward into the next section.

The smaller keyless instrument upon which the indication appears in the adjacent box.

Immediately after lowering his signals, the man in No. 1 box signals two beats on the bell signifying "train entering section," and this signalman No. 2 acknowledges by repeating it, at the same time altering his key-disc instrument and consequently the keyless instrument in box No. 1, to "train on line." As soon as the train has passed the No. 1 box the No. 1 signals are restored to the normal "danger" position.

The signalman in box No. 2 does not wait for the train to arrive, but immediately calls the attention of the signalman in box No. 3 by giving one beat on the bell, and the process just described is repeated. In this way the train is passed along to box No. 3, and so on from one box to another throughout its journey, each step in its progress being prepared in advance.

When the train has passed the "clearing point" at box No. 2 the signalman in that box gives to box No. 1 the train "out of section" signal—two beats, followed by a pause and then one beat—and at the same time unpegs his instrument so that both it and the instrument in box No. 1 return to the normal position.

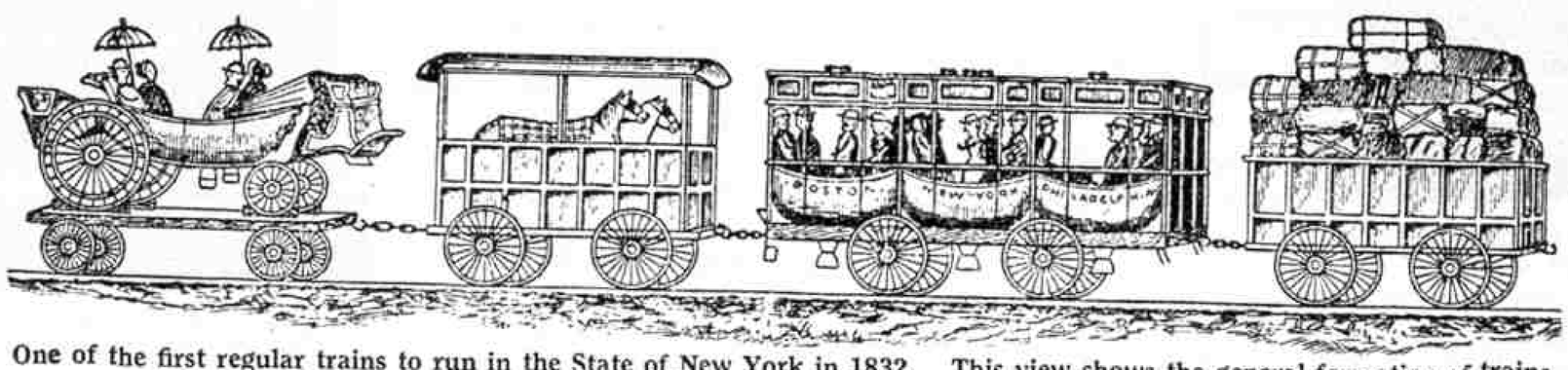
Before a signalman gives the "train out of section" signal he must be certain that the whole of the train has passed, and that no part of it has become detached during its journey from the previous signal box. For this purpose every train always carries a lamp at the rear. This lamp, which is called a "tail" lamp, is painted red and at night shows a red light. The L.M.S.R., however, use tail lamps painted aluminium colour to enable them to be more readily seen against the dark mass of the train. The bulb or light is, of course, red as usual. When a signalman sees this lamp at the rear of the train he knows that the train is complete, but if he does not see the lamp he assumes that some portion of the rear of the train has broken away and is left somewhere in the section. He then takes immediate steps to prevent any other train entering this section and at the same time he signals to the box ahead: "Train passed without tail lamp"—nine consecutive beats—and accordingly the train is stopped at the next box and held up until the matter is investigated.

If a signalman gives four beats on the bell, inquiring if the line is clear, and receives no response, he repeats his four beats at intervals until the man in the next box gives them back to show that the line is clear.

Early American Railway Vehicles

The First Steps Towards Modern Comfort

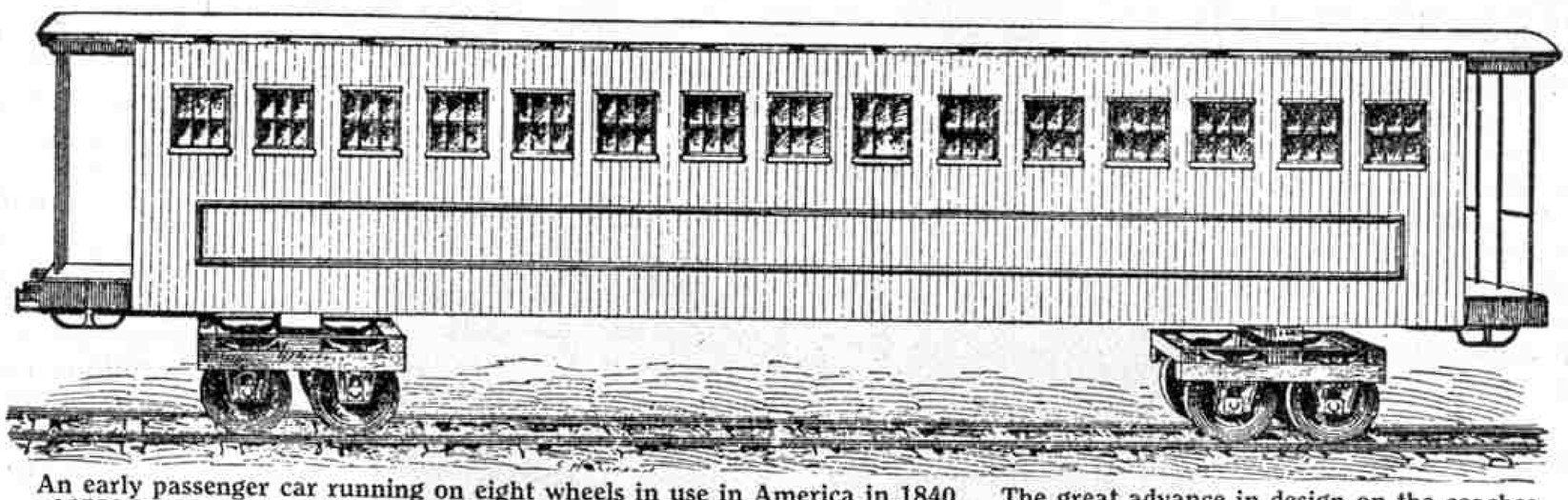
THE train shown in the upper illustration on this page was one of the first to operate regularly in the State of New York in 1832. If the accuracy of the picture is to be trusted, the passengers must have had a rough time; for plain chain couplings appear to have formed the only connection between the vehicles, and no buffers are fitted! The jolts when taking up the slack on starting, and the bumps when speed was reduced for a stop, must have been extremely unpleasant; and the generally light construction of the vehicles gives reason for thinking that these would not stand up for long to such treatment. The passenger coach is finished in quite an elaborate style, and this feature and other details, such as the primitive iron steps, are obviously derived from road coach practice. The use of a separate wagon for the conveyance of the passengers' luggage is worthy of notice, for at that time it was usual to carry this on the roof of the passenger coach itself. In this case the luggage seems to be piled up to the limits of the loading gauge, and does not appear to be protected in any way from rain or from sparks from the locomotive which, by all accounts, were very plentiful in those days.



One of the first regular trains to run in the State of New York in 1832. This view shows the general formation of trains at that period, when passengers were able to travel in their own carriages mounted on flat railway trucks.

At the tail of the train is a party travelling in a road carriage mounted on a flat wagon. This was a common practice at that time, and was also a feature of English travel, for those who could afford to do so generally preferred this method to making use of the regular railway carriages. The horses in the adjacent vehicle seem to have accommodation practically as good as that of their owners.

Experience of the discomfort of such vehicles no doubt had a great influence on subsequent railway carriage design, for a gap of only eight years separates the car shown in the lower illustration from those in the train above. This car runs on eight wheels disposed on two bogie trucks. The appearance of the vehicle is rather top-heavy, and the bogies have a very short wheelbase, so that the behaviour of this car must have been rather disconcerting at times. Nevertheless the design is a notable advance upon the earlier attempts, and we can recognise the general elements of American car construction that have been preserved down to the present day. The use of bogies, for which the Baltimore and Ohio Railroad were responsible in 1835, soon became characteristic of American vehicles, both passenger and freight; whereas bogie coaches were not common in Great Britain until some years later. The six-wheeler was still to be found in the make-up of many expresses in this country even after the opening of the 20th century.



An early passenger car running on eight wheels in use in America in 1840. The great advance in design on the coaches of 1832 is apparent, and there is some resemblance to the cars of the present day. The first bogie coach in the United States was introduced by the Baltimore and Ohio Railroad in 1835.

A typical American bogie car of about 1840 was from 35 ft. to 40 ft. in length and had a height in the body of about 6 ft. 6 in. Its comparative narrowness made it awkward inside, for the seats on each side of the central passage were too short to accommodate two average-sized people in comfort. The building of coaches on the centre-corridor plan adopted at this early date was for a long time a typical American feature. British corridor coaches have been mostly constructed with side corridors, but the centre-gangway type of construction, with a vestibule, has come more into favour in recent years. This type has many advantages. It is more economical, for both sides are alike, owing to the absence of doors except in the vestibules; and a coach is better balanced with the passage in the centre and the seats flanking it than with the corridor running along the whole of one side of the coach. Further, as tables are usually fitted, the kitchen car is able to cater for the whole train simultaneously, so that passengers are not required to leave their seats and proceed to a separate dining car.

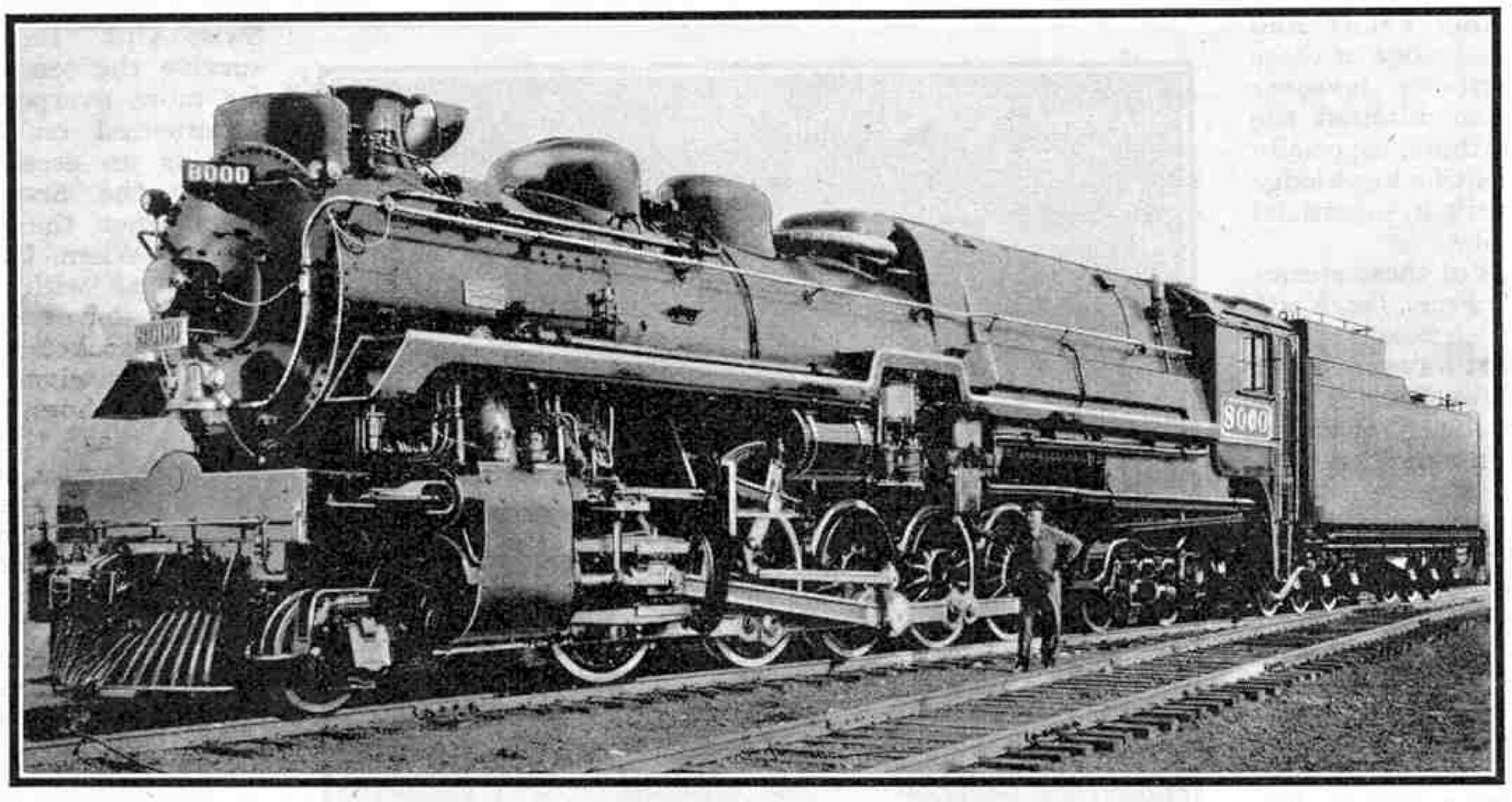
The first definite practical step towards improving the degree of comfort of American passenger vehicles was taken in 1858. In that year Mr. George M. Pullman placed in service on the Chicago and Alton Railroad two sleeping cars, these being coaches placed at his disposal by the company, and converted and re-fitted according to his own original ideas. These vehicles met with immediate success, and led to the construction of the first real Pullman sleeping car, which was built to meet the requirements of long-distance travellers. The popularity of this car—which was appropriately named "*Pioneer*"—and its successors led to the incorporation of the Pullman Palace Car Company in 1867, by which time Mr. Pullman owned a total of 48 cars.

New High-pressure Compound Locomotive

Interesting C.P.R. Development

THE Canadian Pacific Railway have produced a new locomotive that is the largest and most powerful of its kind in the world, and the first of its type on the American continent. This locomotive, numbered "8000," has been built for use in passenger and freight service in the Rockies.

A few figures in regard to this monster locomotive will give some idea of its size. The weight of the engine is 485,000 lb., and that of the tender 300,000 lb.; a total of 785,000 lb., or about 350½ tons. The length overall of the two is 99 ft. 3⅜ in. This represents an increase in weight of 44,800 lb., and an added length of 1 ft. 2 in., over the "5900" series locomotive, the largest prior to the construction of the "8000." The ten driving wheels are 63 in. in diameter. The two low-pressure cylinders, situated outside the frame, and using superheated steam at 250 lb. pressure per sq. in., are 24 in. in diameter by 30 in. stroke. The high-pressure cylinder, situated between the frames, and using superheated steam at 850 lb. pressure, is 15½ in. in diameter by 28 in. stroke, and transmits its power through a piston and connecting rod to a crank axle placed at the second pair of driving wheels.



A remarkable 2–10–4 locomotive recently introduced by the Canadian Pacific Railway, to whom we are indebted for this photograph. This engine is a three-cylinder compound, and its boiler is of special design, generating steam at three different pressures.

The tractive effort of the locomotive is 90,000 lb., an increase of about 17,000 lb. over the "5900" series. This means that on a level track the "8000" will be able to haul a train of 150 forty-ton freight cars, with a total weight of 6,000 tons, and over a mile in length. The tender has a capacity of 12,000 gallons of water and 4,350 gallons of fuel oil. The aggregate length of all the seamless steel tubes used in the construction of the boiler units alone amounts to 18,695 ft., or slightly over 3½ miles.

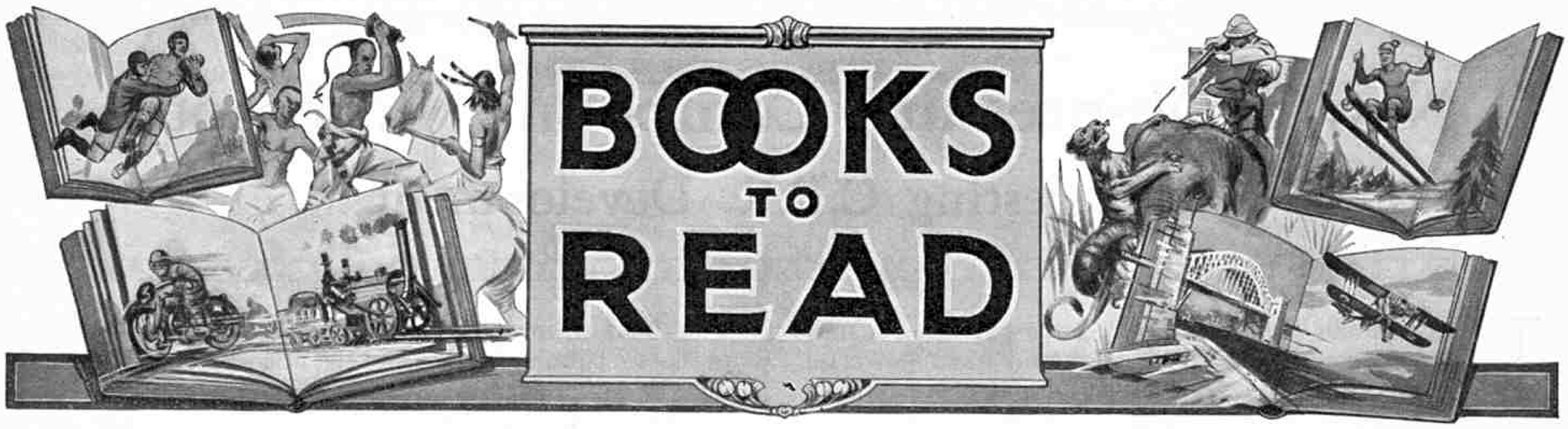
The "8000" is termed a "multi-pressure" locomotive because steam is generated in three separated portions and at three different pressures. The fire-box and combustion chamber are formed by tubes in which steam at 1,300 to 1,350 lb. pressure per sq. in. is generated from distilled water. The water in this system, heated by the furnace gases, is converted into steam that passes through coils inside the high-pressure drum. The heat from this steam passes through the walls of these tubular coils, and is absorbed by the water in the high-pressure drum. The condensate flows downward to the bottom of the fire-box and is re-circulated through the tubes without loss.

The water in the high-pressure drum is heated as just described, and is converted into steam at 850 lb. pressure. From the high-pressure drum this steam passes through a superheater and a throttle to the high-pressure cylinder. The low-pressure boiler, which resembles the barrel portion of the conventional locomotive boiler, generates steam at 250 lb. pressure. This steam flows through a second superheater and throttle and into steam pipes that join the exhaust steam pipes from the high-pressure cylinder. The steam exhausted from the high-pressure cylinder joins with the steam from the low-pressure boiler, and flows to two low-pressure cylinders situated in the normal position.

The fire-box unit is designed for 1,700 lb. pressure per sq. in., with an average working pressure of about 1,350 lb. This unit is really a closed circuit containing approximately 300 gallons of distilled water. The object of using distilled water is to prevent the accumulation of sludge and scale. The closed circuit extends into the high-pressure boiler drum in the form of 16 coils, called heat transfer coils.

There are three locomotives of this type in Europe, which are showing excellent savings in fuel, ranging from 25 to 35 per cent. in comparision with the conventional design of locomotive. The largest of the European locomotives is only 42 per cent. of the weight, and develops only 36 per cent. of the power of the "8000."

Although this engine is the first operating on this particular system on the American continent, several other high-pressure designs are in use. Of these, three on the Delaware and Hudson Railroad are two-cylinder compounds with water-tube fire-boxes built by the American Locomotive Company; while the Baldwin Locomotive Works have also produced a three-cylinder compound with a similar fire-box.



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Old Swan, Liverpool, adding 1/- for postage to the price. Postages on different books vary, but any balance remaining will be refunded.

"The Conquest of Space"

By DAVID LASSER. (Hurst & Blackett. 7/6 net)

Many romantic stories have been woven round imaginary voyages to the Moon, and even to Mars, Venus and Jupiter. In the past none of these has been taken seriously, however much we may have admired the ingenuity of the authors, especially when a tinge of scientific knowledge has given their work a superficial appearance of reality.

The most famous of these stories is Jules Verne's "*From the Earth to the Moon*," in which most readers of the "*M.M.*" must have revelled. Verne's explorers travelled through space in a gigantic shell shot out of an immense cannon sunk into the Earth. A speed of seven miles per second was necessary to enable the shell to escape from the Earth's attraction, and this was provided by the explosion of 500 lb. of gunpowder in the breech of the cannon. Fortunately Jules Verne's imaginary experiment was never tried, for the occupants of such a shell would have been crushed against its floor by the force due to the sudden acceleration on firing the gun. Even if they survived this fate, they would have been roasted to death, for a projectile hurled through the atmosphere with a speed of seven miles per second would flame into incandescence like a meteor. Later writers avoided trouble of this kind by imagining forces that neutralised gravitational attraction, in order to convey their explorers away from the Earth, and with the aid of this their heroes made acquaintance with gigantic reptiles supposed to exist on Jupiter, or with astonishing people said to lurk in underground caverns of the Moon.

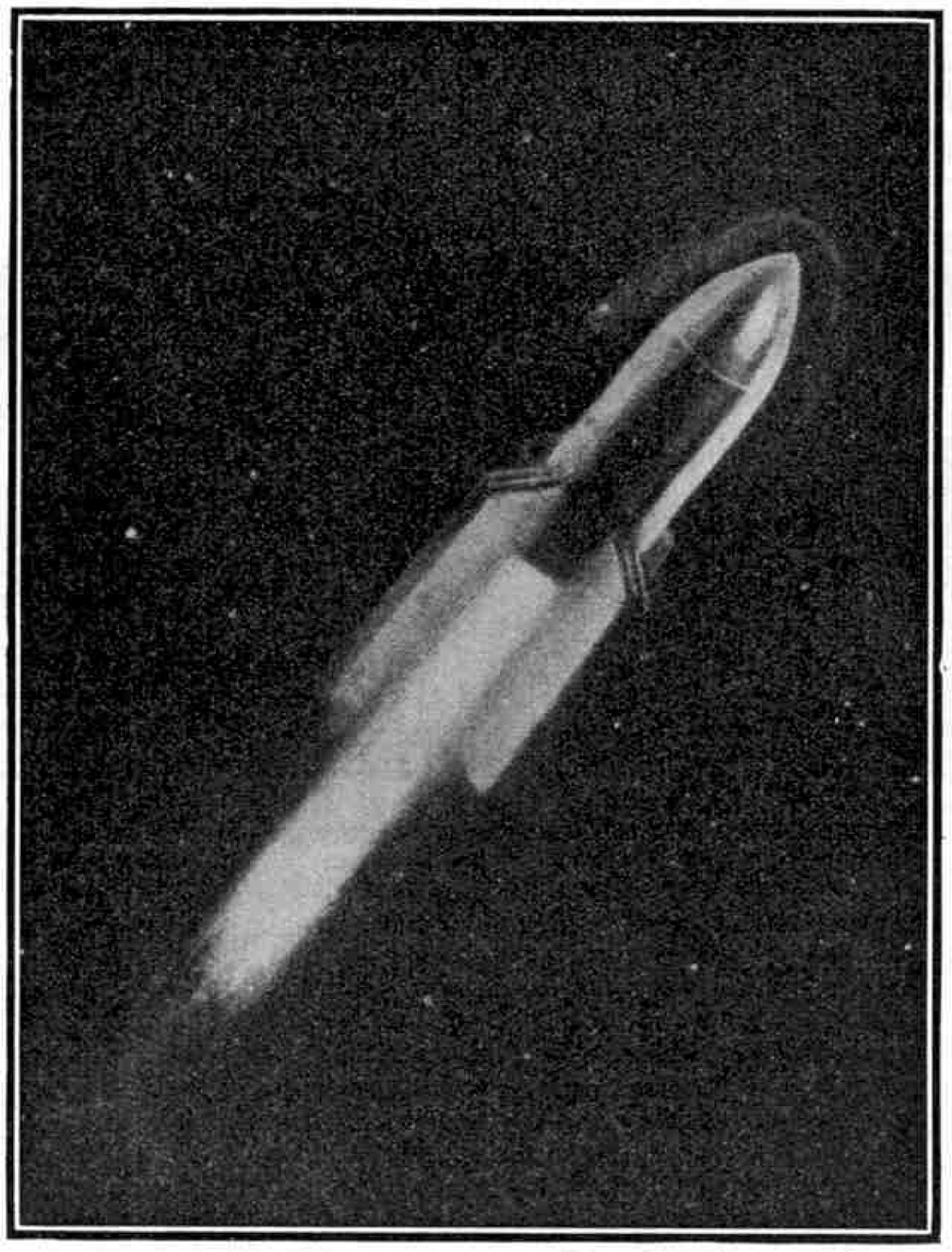
Since these stories appeared an astonishing development has taken place that has lifted the idea of a journey to the Moon, or indeed to one of our neighbouring planets, from a storybook romance to a scientific possibility. This is the transformation of the rocket from a mere firework into an engine capable of giving tremendous speeds to motor cars, aeroplanes, and even space-ships designed to cover the 240,000 miles of airless space between the Earth and the Moon, or the 26,000,000 miles to Venus. "*The Conquest of Space*" tells the story of the transformation, in which the chief parts have been played by M. Esnault-Pelterie, a French engineer; Dr. Goddard, an American professor, and Dr. Oberth, an Austrian scientist.

Rockets recently have been used to give an aeroplane a speed of 85 miles per hour while travelling a distance of more than a mile, and to drive motor cars at speeds of 70 miles per hour; and a rocket-flying field has been established near Berlin to enable further experiments to be made with large rockets charged with petrol and liquid oxygen instead of gunpowder. The development of experimental rockets into space-ships is a very great step, but the author calmly explains proposals for constructing a vessel in which a voyage to the Moon would be an easy matter. This suggested Moon rocket weighs 5,120 tons and carries a charge of 4,380 tons of fuel. It is made in three sections or "steps." Each of these steps contains the fuel required to propel the rocket on a portion of its journey through space, and immediately its work is finished it is to be detached and blown into millions of fragments by explosives. This method of construction would enable the speed to be gradually increased, and thus explorers making use of the rocket would avoid the fate that most certainly would have befallen Jules Verne's heroes.

One of the most fascinating sections of this book describes an imaginary journey to the neighbourhood of the Moon in a vessel weighing 10,000 tons, shot out into space from a construction camp in the Swiss Alps. Its daring occupants survive the sensation of pressure, far more overpowering than that experienced on Earth when beginning an ascent in a lift, that marks the first stage of their flight when the rocket is gaining speed. When they recover they are faced with new difficulties, however, for everything within the gigantic rocket is weightless, and they themselves have to wear thick steel shoes, that are attracted by the magnetised floor of their saloon, in order to avoid rising to the ceiling when making unguarded movements. Unfortunately the space-ship does not carry a sufficient reserve of fuel to enable a landing on the Moon to be made, and therefore after circling our satellite the homeward voyage is begun. Eventually the vessel falls into the Atlantic Ocean.

The author does not suggest that the time has yet come for a voyage through space to the Moon, or to any other member of the solar system; but he is confident that by 1950 we shall be familiar with rocket planes travelling swiftly at heights of 50 miles or more above the Earth. We shall then become accustomed to the sensation of being rushed along at speeds of 1,000 miles per hour, and the exploration of space will not appear an idle dream. The faint-hearted may be encouraged by the carrying out of a proposal by Oberth, one of the pioneers of rocket propulsion, that an artificial Moon should be built in the form of a rocket, and shot upward at a speed of about five miles per second. This speed would carry it to a height of about 500 miles, and leave it there circling round the Earth for ever to form a floating landing stage in the ocean of space!

Problems of all kinds connected with rockets, and the possibilities of exploring space with their aid, are fully considered in other sections of the book. Life in other worlds is also dealt with, and reference is made to the great advances in knowledge that will follow when, in the words of an early prophet of space flight, we shall become "tired of this . . . speck, with its



The Rocket in flight. From "The Conquest of Space," reviewed on this page.

monotonous ocean, leaden sky, and single Moon that is half useless," and seek new glory in exploring at least the solar system.

The book is written in a simple and interesting style, and contains no unnecessary technicalities. It is the first book on rockets in the English language, and readers will find it extremely fascinating.

"Stamp Collecting"
By STANLEY PHILLIPS
(Samson, Low and Marston Co. Ltd. 6/–)

This book, written by an authority in a pleasing way that holds the interest from cover to cover, is divided into three parts. The first deals with posts and the postage stamp; the second gives practical hints on forming a collection; and the third concerns the hobby of stamp collecting generally.

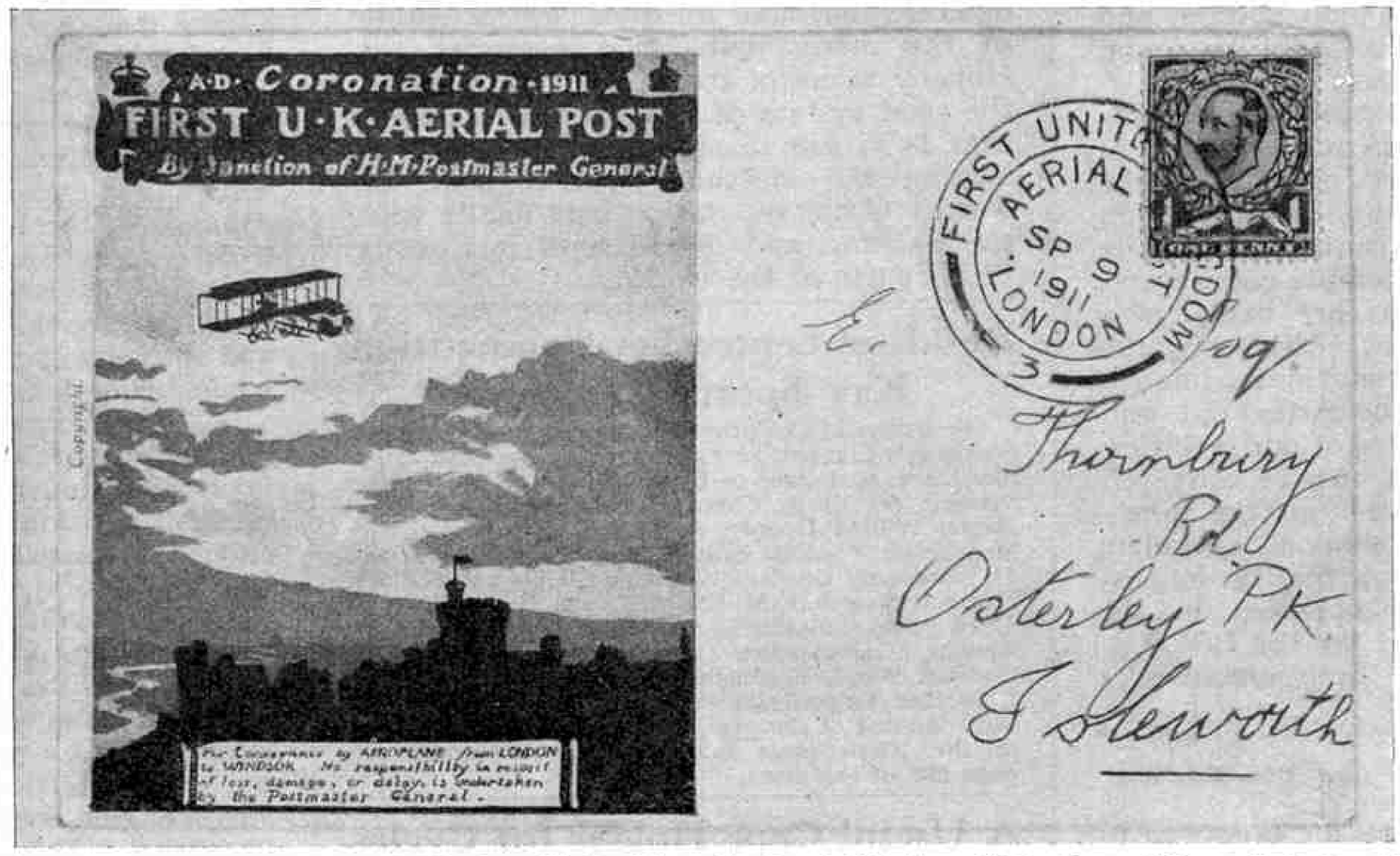
The story of the post commences in the times of the empires of antiquity, the rulers of which—for the preservation of themselves and their dominions—were forced to establish courier services by which messages could be transmitted easily and rapidly. Such messages might be carried hundreds, or even thousands of miles, over the great roads adequately provided with relay stations. From the clay tablets of Babylon we are taken in easy stages to the establishment of the first Post Office Act, passed by Cromwell in 1635.

Of the coming of the postage stamp and stamps and their uses, the author naturally has a good deal to say, and he devotes a separate chapter to commemorative and charity stamps. We are taken into the printers' confidence and shown how a postage stamp comes into being, from the first rough sketch to the finished article sold over the counter. In this chapter the differences of printing and the various kinds and colours of paper are fully explained, as also is the question of watermarks and perforations. A chapter on errors and varieties that arise even in the best printing offices is followed by a description of overprints and surcharges, with some indication of the manner in which errors of overprint are caused. The difficulty of determining the colours of stamps is discussed, as are postmarks and obliterations.

In Part II the collecting of stamps is dealt with at length. We learn what to purchase in the way of an outfit; then we are told how to get stamps and how to identify them. The arranging of the collection is an important subject and is given a chapter to itself. Specialisation, new ways of collecting, and stunt collections are dealt with in subsequent chapters. and air stamps and covers are given due attention.

Consideration of the investment or speculative side of stamp collecting leads us to the conclusion that common stamps can be ruled out as a likely source of profit, and that many stamps that were common seventy or eighty years ago are still common to-day. Obviously, therefore, many of the low value new issues of to-day, which are printed in much larger quantities than those of early days, will remain common for many decades to come. The author very wisely points out that "except for an occasional speculation . . . there is no great fortune to be made out of medium-priced stamps. A collection of these will show a better return than one of common stamps if a really long period is allowed to elapse between purchase and sale—say, 20 years or so. Even then it is doubtful that a real profit will be shown if the compound interest value of the capital invested be reckoned." This is "good reading," for we have always held that stamps should be collected for their own sake and not with a view to ultimate gain by speculation.

The author set out to provide the answer to the problems and queries that face the keen stamp collector at every stage of his progress and he has gone a long way towards succeeding in his task. This eminently practical book will be found useful not only by the beginner but by the general collector also, and we do not hesitate to recommend it to those of our readers who are collectors. A word must be said about the excellence of the illustrations to this book. There are 64 plates and each carry illustrations of interesting stamps.



A cover used on the first United Kingdom Air Post from London to Windsor, 1911. From "Stamp Collecting," reviewed on this page.

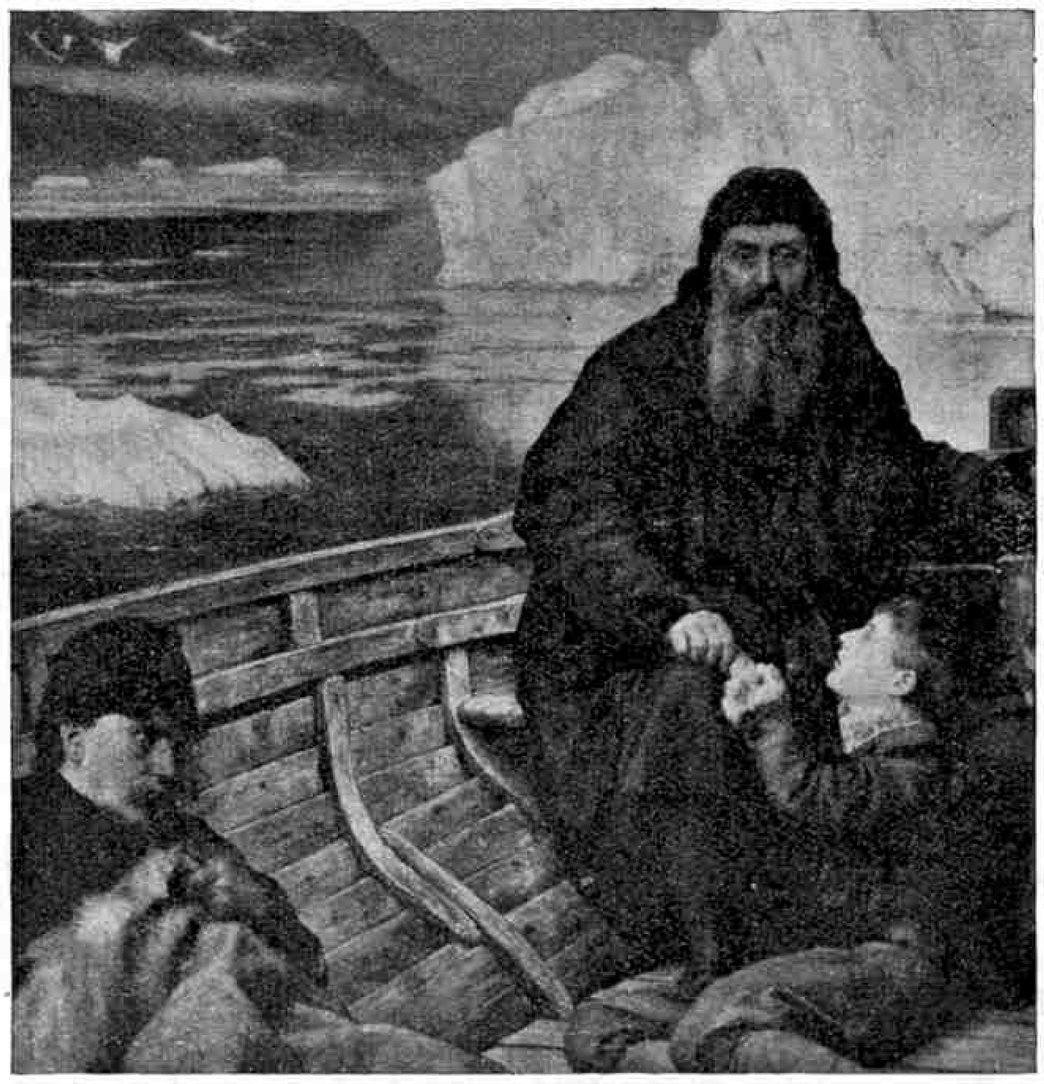
"More Boys and Girls of History"
By R. and E. POWER
(Cambridge University Press. 7/6)

In this second collection of stories of children, which follows "Boys and Girls of History," the authors tell of children who witnessed or shared in the adventure of establishing England overseas. Most of the stories depict some episode in the history of discovery or the growth of the Colonial Empire. There is a fine spirit of adventure running through most of the chapters, especially those that describe the early voyages of discovery.

The stories all belong to the period subsequent to the Middle Ages, and the authors have endeavoured to see the events described, not only through the eyes of the adventuring or conquering English, but through those of the little Irish girl, the Red Indian princess, or the chief's son of Kandy, the Burmese, the Maori and the Australian "Black fellow," and they have attempted to describe their daily lives.

They have shown, too, splendid failure as well as splendid success—as, for instance, the desertion of Henry Hudson by his sailors, and the execution of Raleigh, as well as the triumphant return of Cabot, and the growth of the East India Company.

This is a fine book that will appeal to all boys—and girls as well—and the illustrations add greatly to the interest.



The last voyage of Henry Hudson. From "More Boys and Girls of History," reviewed on this page.

Interesting New Books

The undermentioned books, recently published, will be reviewed in a future issue.

EVERYMAN'S WIRELESS
by C. L. Boltz. (Harrap, 7/6)

BLUEJACKET AND CORSAIR
by J. G. Rowe. (J. Alfred Sharp, 3/6)

VILLAGES OF ENGLAND
by Wickham. (B. T. Batsford, 12/6)

THE ELECTRICAL AGE
by V. H. L. Searle, M.Sc. (E. Benn Ltd. 10/6)

THE COURT MARTIAL OF THE 'BOUNTY' MUTINEERS
by O. Rutter. (Wm. Hodge & Co. Ltd. 10/6)

TOURING THE ANCIENT WORLD WITH A CAMERA *by* C. G. Holme and W. Gaunt.
(The Studio Publications, 7/6)

A PICTURE BOOK OF EVOLUTION
by C. M. Beadnell. (Watts & Co., 10/6)

BEES, WASPS, ANTS AND IRATE INSECTS OF THE BRITISH ISLES
by Edward Step. (Warne & Co. Ltd., 10/6)

Junior Section—(*Continued from page 885*)

company actually have running powers from the joint system around Chester on to Warrington and Manchester. The illustration on the previous page shows miniature L.M.S.R. and G.W.R. trains alongside the same platform at a joint station, and the combination will no doubt be found interesting by our readers.

Apart from this kind of joint or connecting working, there is also the question of connections and through workings on the same system. The operation of a junction station on a Hornby layout may be made far more interesting if definite connections between different trains are made as a matter of course. Frequently, too, the transfer of coaches from main line to branch line trains may be carried out, and there is also the problem of odd vehicles, such as Milk Vans, that may be conveyed by passenger train, apart from the necessary provision of goods services. Readers may be interested to know that the longest through goods service operated in the British Isles is provided by the L.M.S.R. between Thurso and Bournemouth, a distance of 850 miles.

Life Story of Meccano—(*Cont. from page 863*)

parts remain in this bath for from five to ten minutes, and are then swilled in a tank of clean cold water prior to being placed in the plating vat. This vat contains a solution consisting of nickel sulphate, boracic acid and a chloride such as common salt. An electric current passes through this bath also, and has the effect of transferring the nickel of which the anode is made on to the parts constituting the cathode. The parts remain in the plating vat until the required deposit is obtained.

Certain types of parts such as spanners and screwdrivers actually are polished while they are being plated. In this case a barrel vat is used, and the burnishing is achieved by the tumbling of the parts as the vat rotates.

The Nuts and Bolts are similarly dealt with while they receive their plating of brass, but these parts, in common with all other brass and brass-finished parts, are subsequently lacquered. This process is carried out by dipping the parts in a bath of lacquer and subsequently barrelling them in a heated barrel to even out the coating of lacquer over the whole surface of the parts and to dry them.

Unquestionably the most interesting of the finishing departments is the Enamelling Department, and I propose to deal fully with this in the next instalment of my story. Next month's article will also describe the hand finishing and assembly of the many items that comprise the Hornby Series of trains and rolling stock, the rigid system of inspection and testing that is in use to ensure that everything leaving the Meccano Factory shall be worthy of our reputation, and finally with the packing and despatch of our goods to all parts of the world.

Result of September Competition
Kay Sports Company

The names of the prize-winners in the Kay Sports Company's Competition, announced in our September issue, are as follows:—First Prizes: Master Peter Sterling, 60, Christ Church Road, Eaton, Norwich; Master Wilfred Hooper, 6, Barnfield Street, Denton, Manchester. Second Prizes: Master Norman Watson, 31, Cardonald Gardens, Cardonald, Glasgow, S.W.2; Master S. Saunders, 31, Blackall Road, Exeter, Devon. Third Prizes: Master Norman Law, 286, Westbourne Avenue, Gateshead-on-Tyne; Master T. Hulbert, Godshill Wood, Fordingbridge, Hants.

Further competitions will be announced each month until the end of the year. Full details will be found in the Kay Sports Company's advertisement on page 905 of this issue.

A Useful Cape Holder for Cycles

A novel and efficient spring grip cape holder for cycles has been produced by Herbert Terry & Sons Ltd., at the very moderate price of 1/–. The fitment clips on to the seat pillar stem, or the front of the machine, and firmly grips a cape, small parcels, a spare tyre, or other similar articles. There are no straps, and the holder is instantly opened or closed. High-grade spring steel is used in the manufacture of this fitment, and the cosletized and enamel finish makes it rust-proof. The weight is only 2 oz.

Hobbies 1933 Catalogue

The 1933 edition of the catalogue issued each year by Hobbies Ltd. is even more comprehensive and interesting than its predecessors. In general arrangement it follows in its 300 pages similar lines to previous editions, and as usual fretwork occupies the main portion. There are descriptions and illustrations of every type of fretwork apparatus that could be desired, with special articles giving practical advice on how to start this fascinating hobby. The illustrated designs cover a wide range of useful and ornamental articles, including bookcases, cabinets for china, gramophone and wireless receivers, clock cases, photo frames and letter racks. The general woodworker and the lathe worker will find much to interest them, and the tools listed and illustrated cover the requirements of even the most advanced enthusiast. Among many other attractive items are model sailing boats and steam launches.

The catalogue, with free designs, may be obtained for 9d. from any Hobbies dealer, or direct from Hobbies Ltd., Dereham, Norfolk, for 1/–, post free.

Welland Ship Canal—(*Continued from page 827*)

Ropes $2\frac{3}{4}$ in. in diameter are used. Each is composed of six strands of wire and they have a breaking strength of more than 270 tons. The hoisting speed is 18 in. per minute.

Great care must be taken to ensure that a gate does not swing when being lifted, and for this reason the ropes support an equalising beam carrying a lifting pin that engages with eyes on the gate. There is also a stabilising girder fitted with guide rollers that engage with the main vertical columns of the lifting frame. This girder is free to move vertically but not horizontally. It is not actually attached to the lifting ropes, but these pass through it, and thus side swinging on the part of a leaf while being hoisted is prevented.

A 25-ton crane is incorporated in the mechanism of the pontoon. This has a boom 90 ft. in length, and when it is in the upright position in which it is normally carried, the gate lifter is capable of negotiating the lift bridges when their spans are at their greatest heights. The length of the boom may be increased by 15 ft.

The gate lifter is equipped with a boiler in which oil or coal may be burned. Steam is supplied at a pressure of 155 lb. per sq. in. to the vertical compound condensing steam engine, which drives a 200kw. 230 v. generator. This generator supplies the power for the main gate hoist, and also that required by a series of auxiliary derricks, capstans, pumps and heaters. During hoisting operations the pontoon is kept on an even keel by means of water ballast, the vessel being trimmed by pumping this as required into the forward or aft tanks. In addition, 840 tons of fixed ballast are employed. Of this 235 tons consist of cast iron blocks, and the rest is in the form of paving bricks distributed to a depth of three ft. in all compartments except the water ballast tanks. The pontoon has a false bottom that forms the oil tank.

We are greatly indebted to the Department of Railways and Canals, Canada, and to Mr. G. F. Vollmer, M.E.I.C., A.M.I.C.E., Assistant Structural Engineer, for assistance in the preparation of this article. During a stay in Great Britain, Mr. Vollmer visited the Editorial offices in Liverpool, and placed his album of photographs of work on the Ship Canal at our disposal, in addition to giving valuable information.

MECCANO OUTFIT CABINETS

No. 5 Oak Cabinet OS

These Cabinets are not quite suitable for the latest contents of the Nos. 5, 6 and 7 Outfits, and are therefore being disposed of at bargain prices. They are strongly built of oak and are exquisitely finished. Each cabinet is provided with lock and key.

MECCANO OUTFIT CABINET No. 5 OS
Dimensions: Length, $17\frac{1}{2}$". Width, $12\frac{1}{2}$". Depth, $3\frac{1}{4}$".
Reduced price **25**/–. Postage 1/3 extra.

MECCANO OUTFIT CABINET No. 6 OS
Dimensions: Length, $22\frac{3}{4}$". Width, $12\frac{1}{4}$". Depth, 3".
Reduced price **27/6**. Carriage extra.

MECCANO OUTFIT CABINET No. 7 OS
Dimensions: Length, $26\frac{1}{2}$". Width, 14". Depth, $7\frac{1}{4}$". Reduced price **60**/–. Carriage extra.

MECCANO LTD., Old Swan, LIVERPOOL

THE RAILWAY MAGAZINE

PRINCIPAL CONTENTS
NOVEMBER ISSUE

Some Modern Freight "Flyers."
The Railway of Denmark.
Locomotives of the Railway Operating Division. Royal Engineers, 1916-1919.
Stroudley Reminiscences.
A Sidelight on the North Eastern Railway Jubilee of 1875.
The Barking and Upminster Electrification, L.M.S.R.
The Fastest Trains in Great Britain—I.
Some New L.M.S.R. Speed Records.

The above, all fully illustrated, are in addition to the regular features such as "British Locomotive Practice and Performance" and "The Why and the Wherefore."

THE RAILWAY MAGAZINE
MONTHLY Illustrated ONE SHILLING
33, TOTHILL ST., WESTMINSTER
LONDON, S.W.1

THE ORIGIN OF "*HIS MASTER'S VOICE*"

GENERALLY speaking one would not be inclined to associate romance with a trade mark, which the dictionary solemnly defines as "any name or distinctive device warranting goods for sale as the production of any individual or firm." The trade mark of The Gramophone Co. Ltd., however, has quite an unusual and interesting origin.

It was the merest chance that brought world-wide fame to Francis Barraud's painting "*His Master's Voice*," and the chain of circumstances that led to its being adopted as the trade mark of The Gramophone Company is as remarkable as the picture itself. The artist's brother had a fox terrier named "*Nipper*." This dog was extremely devoted to his master, but treated everybody else with complete indifference. The brother was taken ill and died, and shortly afterwards it occurred to Francis Barraud to see whether the dog would so far modify his previous attitude as to come for a walk with him. To his surprise "*Nipper*" followed him without the slightest hesitation, and the two developed an affection for one another that resulted in "*Nipper*" leaving his old home and going to live with the artist.

This was in the days of the small phonograph, and when the wax cylinders were being played "*Nipper's*" new master noticed how the dog cocked his ears and listened intently whenever the phonograph "talked." Whether one of the recorded voices resembled that of the dog's old master it is impossible to say, but the animal's attitude of intense listening gave Francis Barraud the idea for his picture. He painted "*Nipper*" listening to the phonograph, and gave the picture the title "*His Master's Voice*." It then occurred to him that the picture might interest the manufacturers, and he therefore took it to a company that was prominent at that time in the sale of wax cylinder machines. Curiously enough they do not seem to have been at all impressed or interested; they failed to appreciate either the originality of the underlying idea of the picture, or the fine technique of the painting.

Willem Mengelberg, conductor of the famous Concertgebouw Orchestra, Amsterdam. Photograph by courtesy of The Columbia Graphophone Co. Ltd.

Barraud was very disappointed at this chilly reception of his work. One day he happened to tell an artist friend all about the matter, and this friend suggested that the picture might be improved by the substitution of a brass horn in place of the black one. He added that one might possibly be borrowed from a little concern in Maiden Lane, off the Strand, called The Gramophone Company. So it came about that one day in September, 1899, Francis Barraud made commercial history by walking into the offices of the newly-started Gramophone Company and asking for the loan of a brass horn. He explained the purpose for which he wanted it, and the manager, realising the interest of the idea, asked to be allowed to see the picture. Barraud took it along to Maiden Lane, and then suggested that a gramophone might be painted instead of the phonograph. This was done, and the picture was promptly acquired by The Gramophone Company. The original, showing faint traces of the phonograph, now hangs in a recess over the fireplace in the Board Room of the Company's head office at Hayes, Middlesex.

From the moment of its first reproduction the picture became popular. It told a simple story that appealed to the imaginative sympathy of everyone; and soon it became so inseparably linked with the gramophone that the Company and its associate companies throughout the world adopted it as the trade mark of their products.

The painting that forms the "His Master's Voice" trade mark. By courtesy of the Gramophone Co. Ltd.

A Great Dutch Conductor

Last month I referred to a remarkably fine record of the "Tannhäuser" overture played by the Concertgebouw Orchestra under the direction of Willem Mengelberg, whose portrait I am now able to reproduce. This famous conductor was born at Utrecht on 28th March, 1871, and started his musical education when quite a small child. After a thorough period of study at the Utrecht Music School and in Cologne, Mengelberg decided upon the career of a conductor, his first important post being at Lucerne. He became conductor of the Concertgebouw Orchestra, Amsterdam, the leading orchestra of Holland, in 1895. He has conducted concerts in all parts of Europe and also in New York, and is universally recognised as one of the foremost conductors of the day.

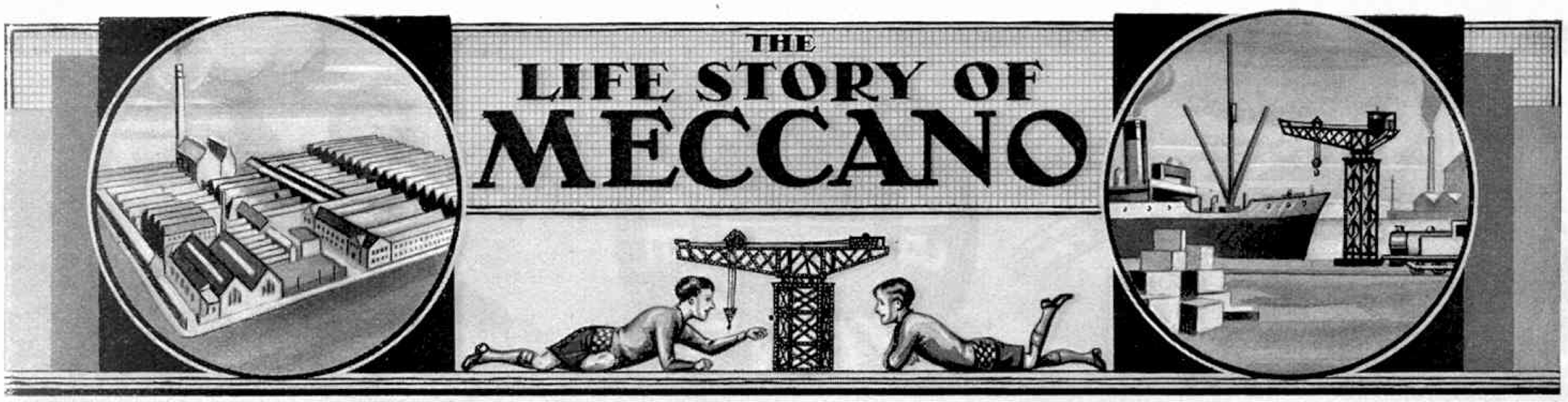
All the Mengelberg recordings are good, and among them the following can be specially recommended. "*Coriolan*" overture, Beethoven, LX167; "*Egmont*" overture, Beethoven, LX161; two "*Elegiac Melodies*," Grieg, LX168, and "*Euryanthe*" overture, Weber, LX157. These are all Columbia Light Blue 12 in. records, price 6/– each.

Fine Choral Recording

Up to the last two or three years the recording of choral music was very unsatisfactory, particularly in its complete failure to give any idea of the volume and brilliance of the original tone. Recent Columbia choral recordings have made quite a remarkable step forward, and they will come as a surprise to those who are only familiar with the old records, which were little more than feeble caricatures.

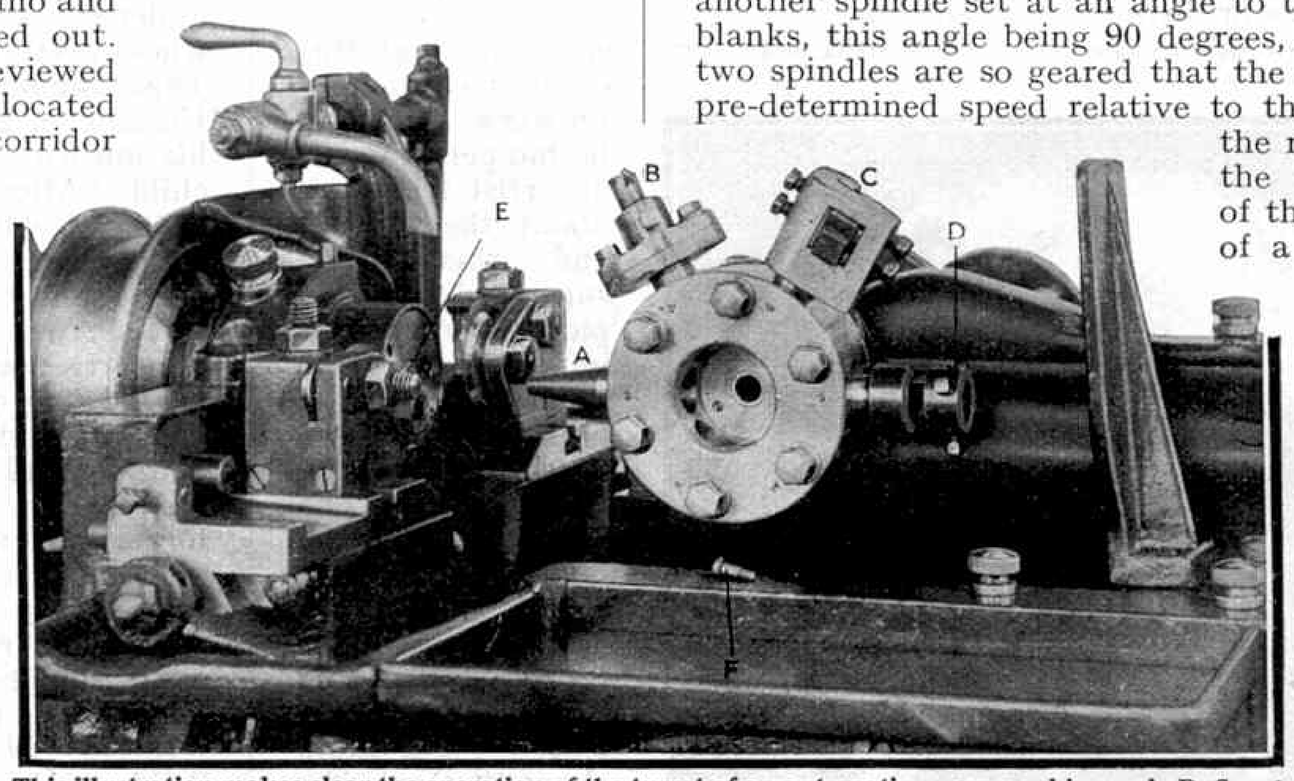
A particularly striking achievement is the record of Luther's hymn, "*A Stronghold Sure*," and "*Let All Men Praise the Lord*," from Mendelssohn's "*Hymn of Praise*," sung by the National Chorus conducted by Stanford Robinson (Col. DX368, 12 in., 4/–). This concert hall recording is remarkable in its strength and decisiveness. There are moments when the voices singing in the higher register produce an almost overwhelming effect, and the tonal volume throughout is very fine.

The singing of a mixed choir of school-children at this year's Cardiff Schools Musical Festival is splendidly recorded on Col. DB892, "*Under The Greenwood Tree*" (Arne) and "*To Sylvia*" (Schubert), and DB893, "*Caller Herrin'*" and "*John Peel*," each 10 in., price 2/6.



X.—A Tour of the Factory. By Frank Hornby

LAST month we described the making of the tools for use in the Press and Machine Departments and dealt with the work of the Press Department where the blanking, piercing and forming of parts for Meccano and Hornby accessories are carried out. The next department to be reviewed is the Machine Department, located at the end of the main corridor shown in the plan of the Meccano factory reproduced in the October *"M.M."* This department has many machines of outstanding interest specially designed for particular types of work. Pride of place is taken by a large battery of various sized automatic screw machines and automatic screw threading machines used for turning all such parts as pinion blanks, pummels, solid pulleys, grub screws, etc. To watch pummels turned at the rate of 30 per minute on an automatic screw threading machine that feeds itself with rods from a magazine holding 20 rods, each 10 ft. in length, is a revelation.



This illustration makes clear the operation of the turret of an automatic screw machine. A, B, C and D are tools in the turret ; E is the point of feed of the rod, and F a finished part. The illustrations on this page are reproduced from the Editor's "Book of Remarkable Machinery," by permission of the publishers, Harrap & Co. Ltd.

The brass rod is automatically fed into the machine up to a swinging stop. It is then gripped by the collet in the spindle, which is revolving at a speed of 5,000 r.p.m. A front cross slide carrying a tool shaped to the desired form of the part to be produced is moved forward by cams and proceeds to turn the rod on the periphery. Simultaneously the drilling spindle, which is revolving at a speed of 2,500 r.p.m. in the reverse direction to the main spindle, moves forward to drill the axis hole of the pummel. It will thus be seen that the drill cuts at a speed of 7,500 r.p.m. On the completion of these operations the tools withdraw and the rear cross slide carrying the part-off tool moves forward and separates the pummel from the rod. The rod is now automatically fed forward again and the whole cycle of operations repeated once in every two seconds.

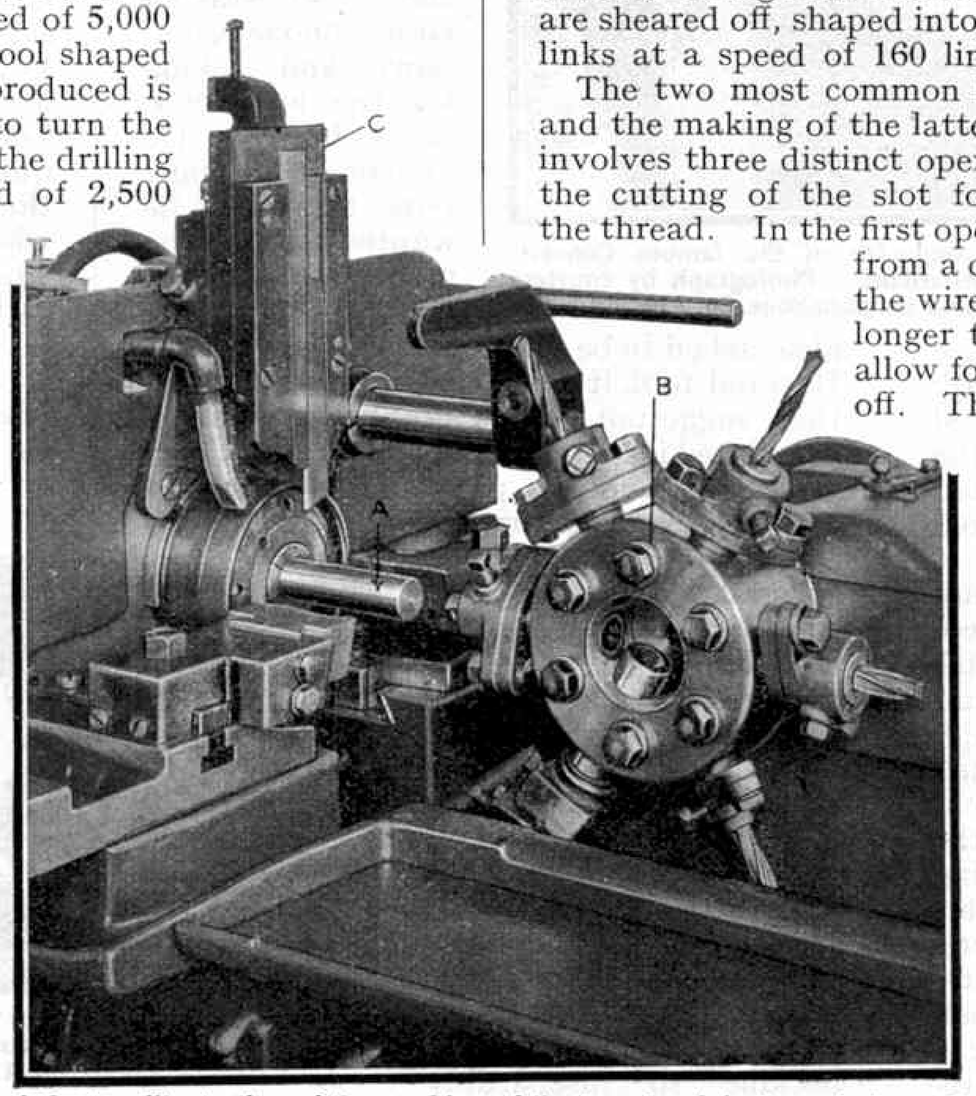
For more complicated work, the automatic screw machines are used. These machines are fitted with a turret at the rear end instead of a drill spindle, and have main spindles that can be reversed during operation. As many as six tools can be fitted into the turret, such as drills, reamers, taps, dies and box tools. Once the machine is set in operation it works fully automatically, every motion being controlled by cams.

Another battery of machines calling for particular attention are the gear cutting machines. These are of various types, but the most interesting are the gear hobbing machines. The blanks on which teeth are to be cut are placed between the centres of the machine and clamped in position. The cutting tool, known as the "hob," is carried on another spindle set at an angle to the work spindle carrying the blanks, this angle being 90 degrees, less the angle of helix. The two spindles are so geared that the cutting spindle revolves at a pre-determined speed relative to the work spindle according to the number of teeth to be cut on the blanks. The cutting teeth of the hob are placed in the form of a worm, that is, at an angle to its axis.

In the case of parts such as gear wheels for clockwork motors, the circular blanks —previously stamped from strips of brass or steel in the Press Department—are clamped together on the spindle until they resemble a short bar of solid metal. The cutting operation is carried out as already described, the length of time required for cutting the teeth on a batch of seventeen 57-toothed gear wheels being nine minutes.

Another most interesting operation in this department is the making of sprocket chain. The chain-making machine works with a coil of fine steel wire that is rolled straight as it enters the machine. Short lengths of wire are sheared off, shaped into links, and linked up with the preceding links at a speed of 160 links per minute.

The two most common Meccano parts are the nuts and bolts, and the making of the latter is carried out in this department. It involves three distinct operations, the heading of the bolt blanks, the cutting of the slot for the screwdriver, and the rolling of the thread. In the first operation steel wire is fed into the machine from a coil, passed through rolls that straighten the wire, and the correct length of wire—rather longer than the length of the finished bolt, to allow for the heading up of the bolt—is sheared off. This length of wire is held in a die while the first operation heading tool gathers the material for the head, the second heading tool smashing it to the correct form. The bolt blank is then ejected out of the die and falls into a receptacle at the base of the machine.



A further illustration of the working of the turret. A is the rod of metal ready for working ; B the turret, holding centring, drilling, reaming and box tools, about to advance on the rod ; C a vertical slide holding the part-off tool. The swinging stop can be seen in the illustration immediately behind the first drilling tool.

The bolt blanks are taken to a second machine and placed in a hopper in which an arm moves up and down automatically, throwing the bolts on to a grooved chute in the front of the hopper. The shank of the bolt must lie inside the groove with the bolt head resting on the upper surface of the chute, so that the bolts travel down the chute and feed one by one into V-shaped notches on the edge of a wheel rotating at the bottom of the chute. This wheel passes under a circular saw that automatically feeds down and cuts the slots for the screwdriver. For

the threading operation the bolts are placed in a similar hopper to that employed in the slotting process, and at the bottom of the chute they are forced into the space between the faces of the thread rolling dies. These are circular in form consisting of a centre drum and outer segments, both of which have the thread form on their faces, the outer segments being stationary, while the centre drum rotates rapidly. The bolt travels with the rotation of the drum, and the threading on the die cuts into the surface of the bolt as it rotates with the drum. The thread rolling machines that we employ now actually thread 240 bolts per minute.

In an annexe to the Machine Department we have a section where the casting of Hornby miniature figures, locomotive buffers, chimneys, wheels, signal finials, etc., is carried out. The casting machine on which the locomotive wheels are made consists essentially of a gas-fired cupola or "pot" in which the metal is melted, fitted with a cylinder and plunger. The cylinder and plunger form a pump that forces the molten metal through a nozzle into a mould or die, the latter carrying the form of the part to be cast. Some machines have manually operated pumps, these being used for the heavier classes of work, while other machines have mechanically operated pumps and are automatic. The dies on the heavy machines are water cooled, those on the others being cooled by air.

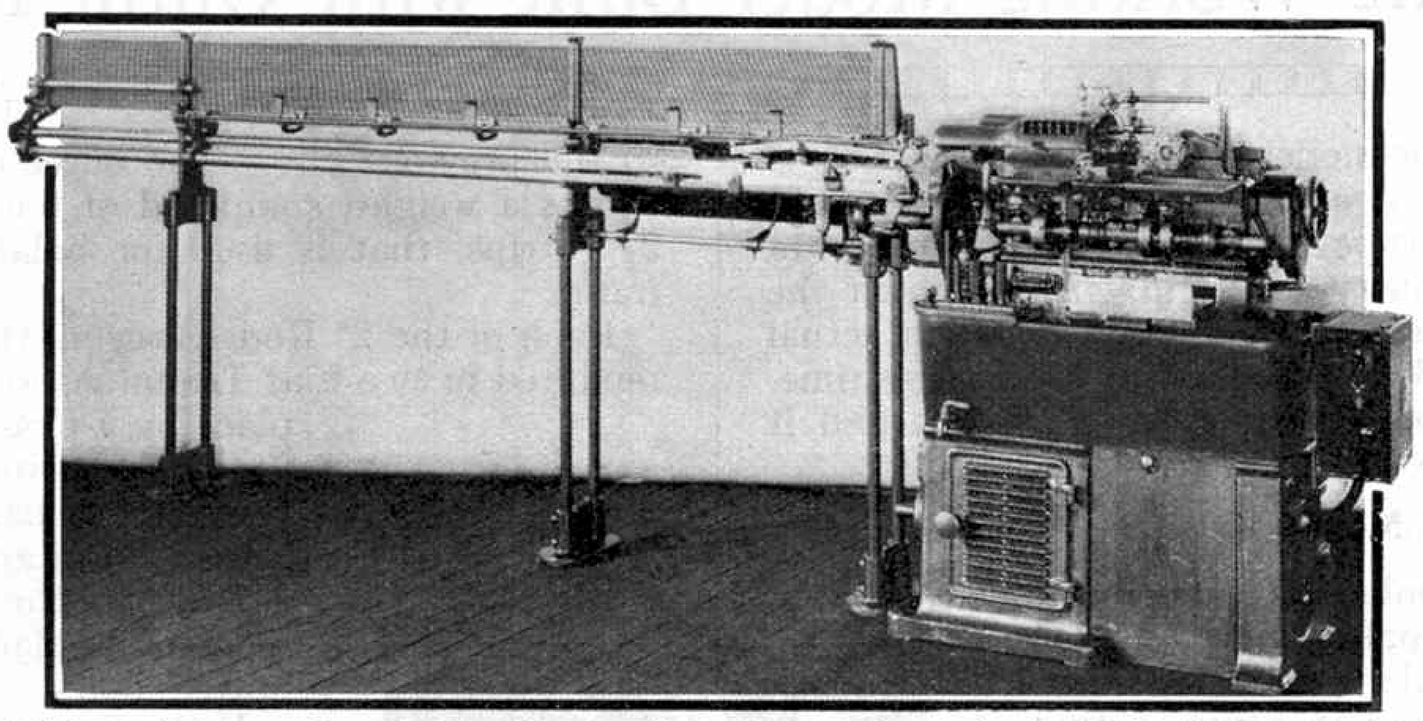
In the case of driving wheels for the larger classes of locomotives the casting consists of one complete set of four wheels; but other types of wheels are cast in sets of six, eight and sometimes twelve.

The miniature figures and farm stock recently introduced into the Hornby series are cast in hand moulds. After the parts of the mould have been clamped together, the lead is poured in from a small ladle filled from a cupola. The metal cools as it touches the side of the mould, and a rapid inversion of the mould syphons the surplus metal from inside the chilled skin back into the cupola. The mould is then separated and the hollow miniature figure removed.

Before the enamelling, plating or finishing processes can be undertaken, the parts must be freed from the oil and grease with which they have been in contact in the machine or press departments, and must be polished to remove any trace of roughness on the edges or surfaces. The polishing and cleaning work may be done in a variety of ways, according to the nature of the particular part.

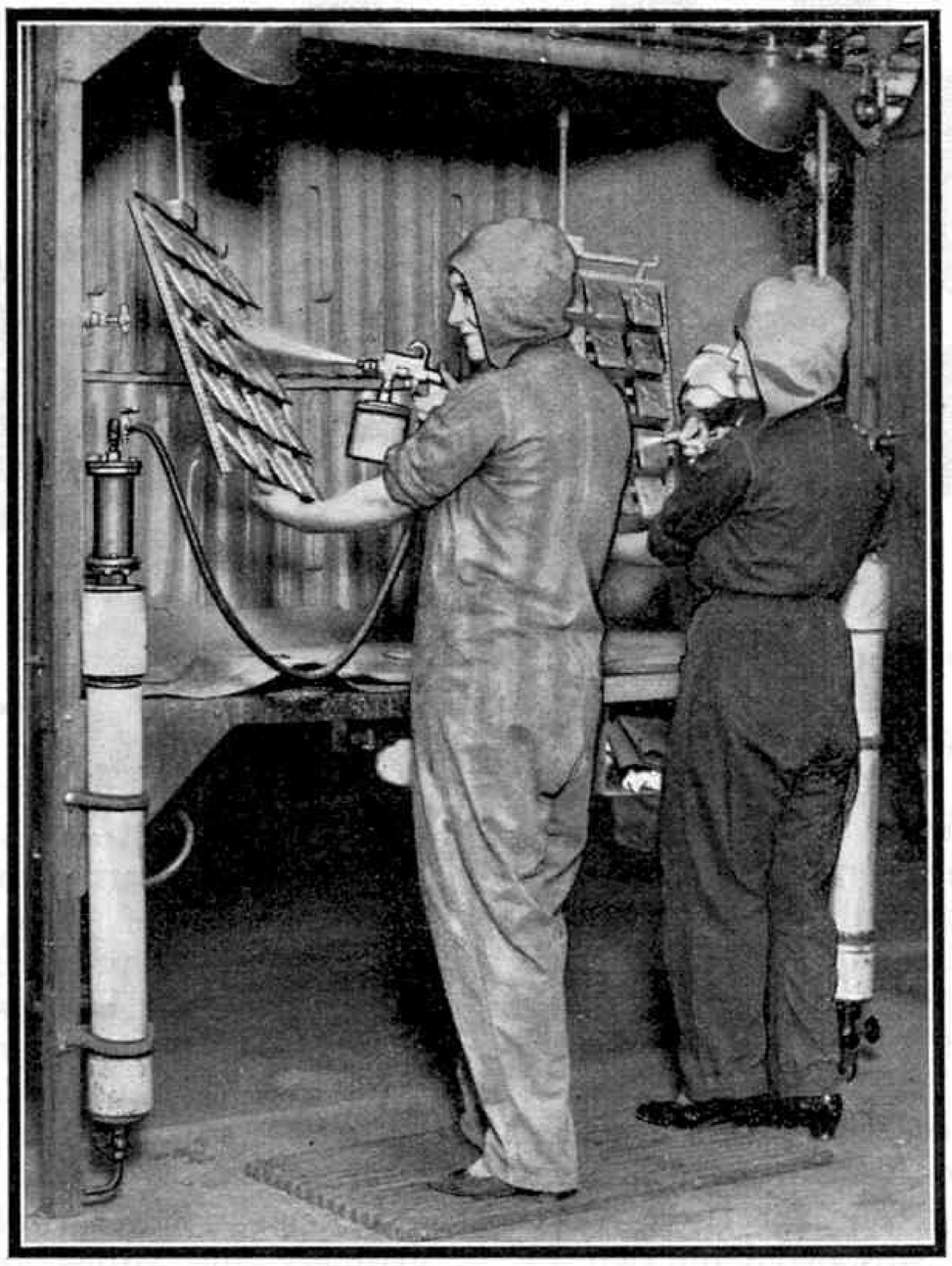
The Barrelling Department is devoted particularly to preparing the parts for enamelling and plating, and must next be considered. I have heard this department colloquially described as the "Meccano Laundry," and indeed a casual glance suggests that the department is equipped with a series of washing machines! These are the barrels into which the parts are placed for the cleaning and smoothing process. The smaller types of barrel use sawdust, and the larger ones scrap leather, as polishing media. The parts are dumped into these barrels and rotated for periods varying from 30 minutes to three hours, and in some cases even longer, according to the nature of the parts. As the barrels rotate the parts tumble one over another, the rubbing having the effect of burnishing them.

In the case of strips, flat plates, girders and similar parts, the bumping about in the barrels has the effect of bending the parts, and subsequently they must be straightened. This is achieved by passing the parts through rolling mills comprising a set of seven rollers mounted three upon four, the clearance between the rollers being adjustable, so that after the strip has passed through it comes out perfectly straight.



A high-speed screw machine complete with automatic feeding magazine, similar to that described in our article.

Although the primary purpose of the barrelling process is to smooth the parts, it does also remove oil and grease, although not to a degree sufficient to permit immediate plating or enamelling. Before either of these processes can be carried out the last traces of grease must be removed. This is done in a variety of ways. In the case of Meccano Strips that are to be enamelled, the parts are laid in mesh-bottomed trays in a vat employing trichlorethylene as the solvent. At the bottom of this vat there is a sump containing the chemical, which is vaporised by heating with steam passed through a pipe in the sump. Immediately above the sump is a coil of steel tube through which cold water is circulated. Above this coil is a rack on which the mesh-bottomed trays are laid, and at the top of the tank is a further coil of steel tubing for the circulation of cold water. After the trays of parts are placed in the tank, it is closed, steam passed into the pipe in the sump, and cold water set in circulation through the coil at the top of the tank. As the vapour rises it acts upon the grease on the parts, loosening it. When the vapour reaches the top of the tank, contact with the cold water coil condenses it into vapour rain which, descending, washes the grease down into the sump. At the end of approximately ten minutes the steam is shut off and the cold water diverted from the upper to the lower coil. Condensation then takes place below the level of the frames containing the parts, and at the end of a further two minutes the tank is sufficiently clear of fumes to permit of its being opened and the trays removed. The parts are then clean and dry.



Spraying operations in progress in the No. 2 Enamelling Department, which will be described in the next article in this series. The enamel is contained in the reservoirs mounted below the spraying pistols, which are operated by compressed air.

Certain types of parts to be enamelled, such as locomotive housings and speedboat hulls, are not suitable for cleansing in this manner, for they contain various corners that prevent the free circulation of the solvent. These parts are de-greased in sweating stoves, the working temperature of which is 280°F., the grease being evaporated away. Since the temperature to be encountered in the enamelling stoves, to which I shall refer later, does not attain a higher level than 220°F., there is no risk of free grease showing itself in any subsequent operation in the finishing processes.

The de-greasing process employed for parts that are to be plated is carried out in the Plating Department itself. In this case the parts are clipped on to frames or strung on copper wires and placed in a chemical bath containing a solution of caustic soda and cyanide of potassium. A current of electricity is passed through the bath from an iron anode, the frame of parts constituting the cathode, and this causes the chemicals to give off hydrogen gas at the cathode. The gas penetrates the film of grease on the parts and forces it off. The

(*Continued on page 860*)

Meccano Embroidery Machine

A Fine Working Model Built with Outfit No. 6

THE prototype of the model described in this article is used for the mass production of embroidery, and machines of this type are found in great numbers in Switzerland, their country of origin. Although in the model provision is made for one needle only, in actual practice as many as 30 needles are in use at one time. The model may be built with a No. 6 Outfit, and it will be found to do excellent work.

Building the Meccano Model

The two bottom members of the main frame each consist of two 12½" Angle Girders secured together by a 5½" Angle Girder. The two 12½" Girders are secured in place so that their inner ends are half-an-inch apart. Two 1½" Angle Girders 1 are also bolted between the inner ends of the long girders. The two complete compound girders are bolted together at their outer ends by two 5½" × 2½" Flanged Plates and in the centre by two 9½" Angle Girders 2. Four 5½" × 2½" Flat Plates are now fitted as shown in Fig. 1 and each of these carries a 12½" Angle Girder lying parallel to the main base girders. Each pair of 12½" Girders is joined together in the centre by 9½" Angle Girders 3.

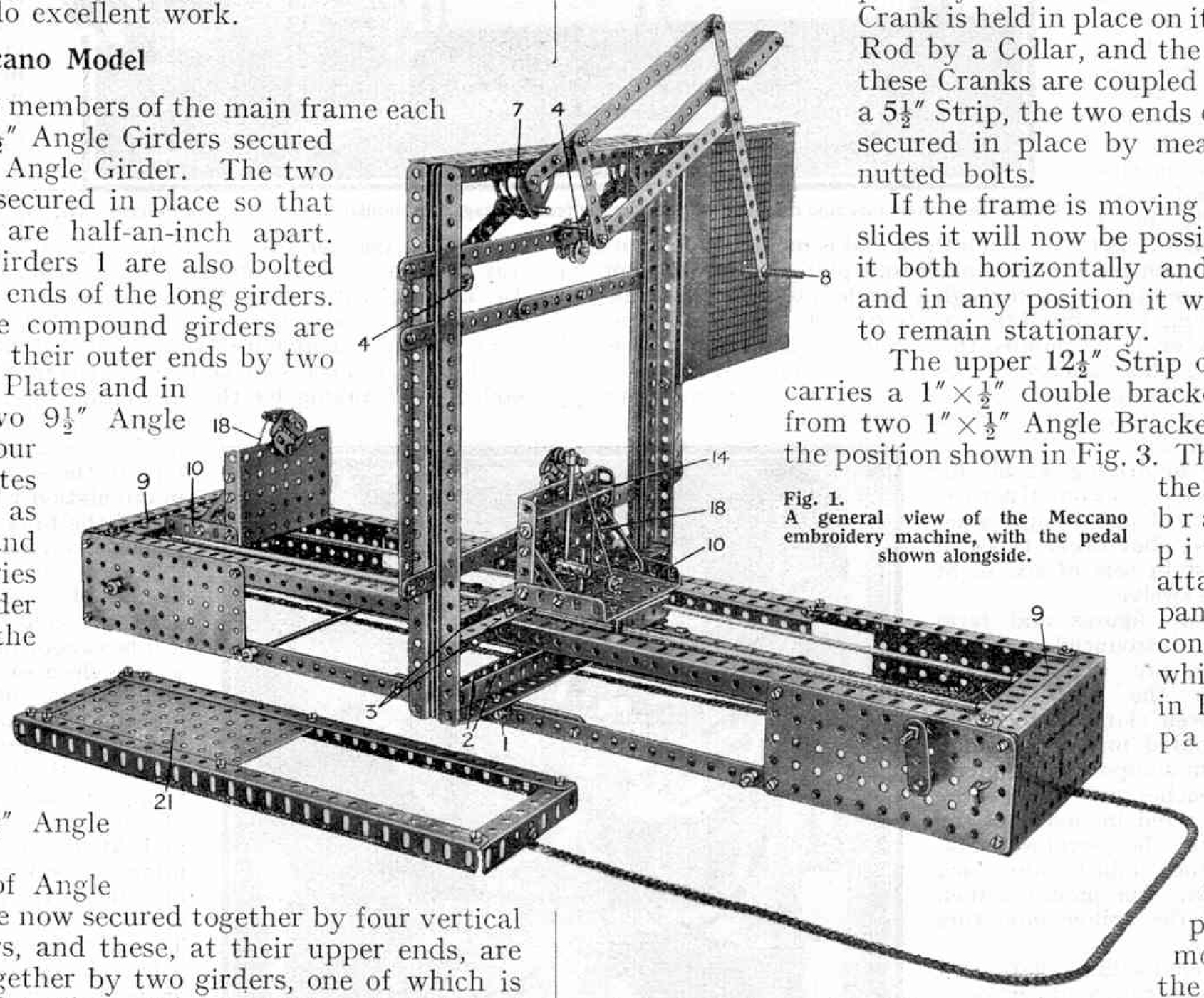


Fig. 1.
A general view of the Meccano embroidery machine, with the pedal shown alongside.

The two sets of Angle Girders 2 and 3 are now secured together by four vertical 12½" Angle Girders, and these, at their upper ends, are rigidly secured together by two girders, one of which is 9½" in length. The other girder is 16½" in length and is built up from a 12½" Angle Girder and a 5½" Angle Girder. At the points where the vertical girders are joined to the upper and lower horizontal girders, ¾" Bolts are used and each of these Bolts supports two 12½" Strips. These Strips are spaced apart by two Washers at each end and one Washer is placed between the Strips and the Girders.

The two vertical slots thus formed are used for guiding the pantograph frame. This frame is composed of two vertical 7½" Strips connected together by three 12½" Strips, the upper one of which is supported on two ½" loose Pulleys 4. A ¾" Bolt carries each of these Pulleys, and five Washers are used between each and its respective supporting Strip. The Bolts are locked to the Strips by means of two Nuts. One of the Pulleys 4 is carried at the end of a 3" Strip bolted to one arm of a Boss Bell Crank mounted on a 2" Rod. The second Pulley is carried at the end of a 12½" Strip secured by its fifth and sixth holes to a second Boss Bell Crank mounted similarly to the previous one. The outer end of the 12½" Strip carries a weight, composed of ten 3½" Strips and seven 2½" Strips, that is used for balancing the pantograph frame.

Each of the 2" Rods carrying the Boss Bell Cranks is mounted in two Flat Trunnions and is secured rigidly in place by a Crank 6. Each Boss Bell Crank is held in place on its respective Rod by a Collar, and the free arms of these Cranks are coupled together by a 5½" Strip, the two ends of which are secured in place by means of lock-nutted bolts.

If the frame is moving freely in its slides it will now be possible to move it both horizontally and vertically, and in any position it will be found to remain stationary.

The upper 12½" Strip of the frame carries a 1" × ½" double bracket, built up from two 1" × ½" Angle Brackets, fitted in the position shown in Fig. 3. The free lug of the built-up bracket is pivotally attached to a pantograph the construction of which is shown in Fig. 1. This pantograph carries a Double Arm Crank 7 that supports a Rod mounted in the two upper girders of the vertical frame. A pointer 8, consisting of a 2" Threaded Rod pointed at one end, is carried at the end of the long arm of the pantograph, and this is moved over a series of ¼" squares drawn on a board that is carried on the projecting end of one of the horizontal upper girders. The board consists of a Designing Table, or if this is not procurable, a smooth piece of wood ¼" thick and 6½" square may be used. The board is divided up into ¼" squares, the purpose of which will be described later.

When the pantograph and frame is complete the needle grippers and slides are constructed. Two 5½" Angle Girders 9 are bolted in place on the frame and each of these carries the ends of two 11½" Rods, the other ends of which are supported in holes in the Girders 3. They are spaced five holes apart and they each carry a slide, the two finished slides being coupled together by means of two 12½" Angle Girders, as shown in Fig. 2. Each slide is built up from two 3½" × 2½" Flanged Plates bolted rigidly together, at right-angles, by means of two large

Corner Brackets. The horizontal Flanged Plate 10 carries on its underside two $2\frac{1}{2}$" Angle Girders spaced $1\frac{1}{2}$" apart. The $11\frac{1}{2}$" Rods, mentioned earlier, pass through the end holes of these Angle Girders, and in this manner the carriages are enabled to slide freely in one direction only. The $2\frac{1}{2}$" Angle Girder nearest to the pantagraph frame carries a $1\frac{1}{2}$" Angle Girder, and to this are secured the $12\frac{1}{2}$" Angle Girders joining the two carriages. These latter Girders are bolted to the $1\frac{1}{2}$" Angle Girder one hole from their ends, the overhanging ends being bridged by means of the $1\frac{1}{2}$" Strips 11 and 11a.

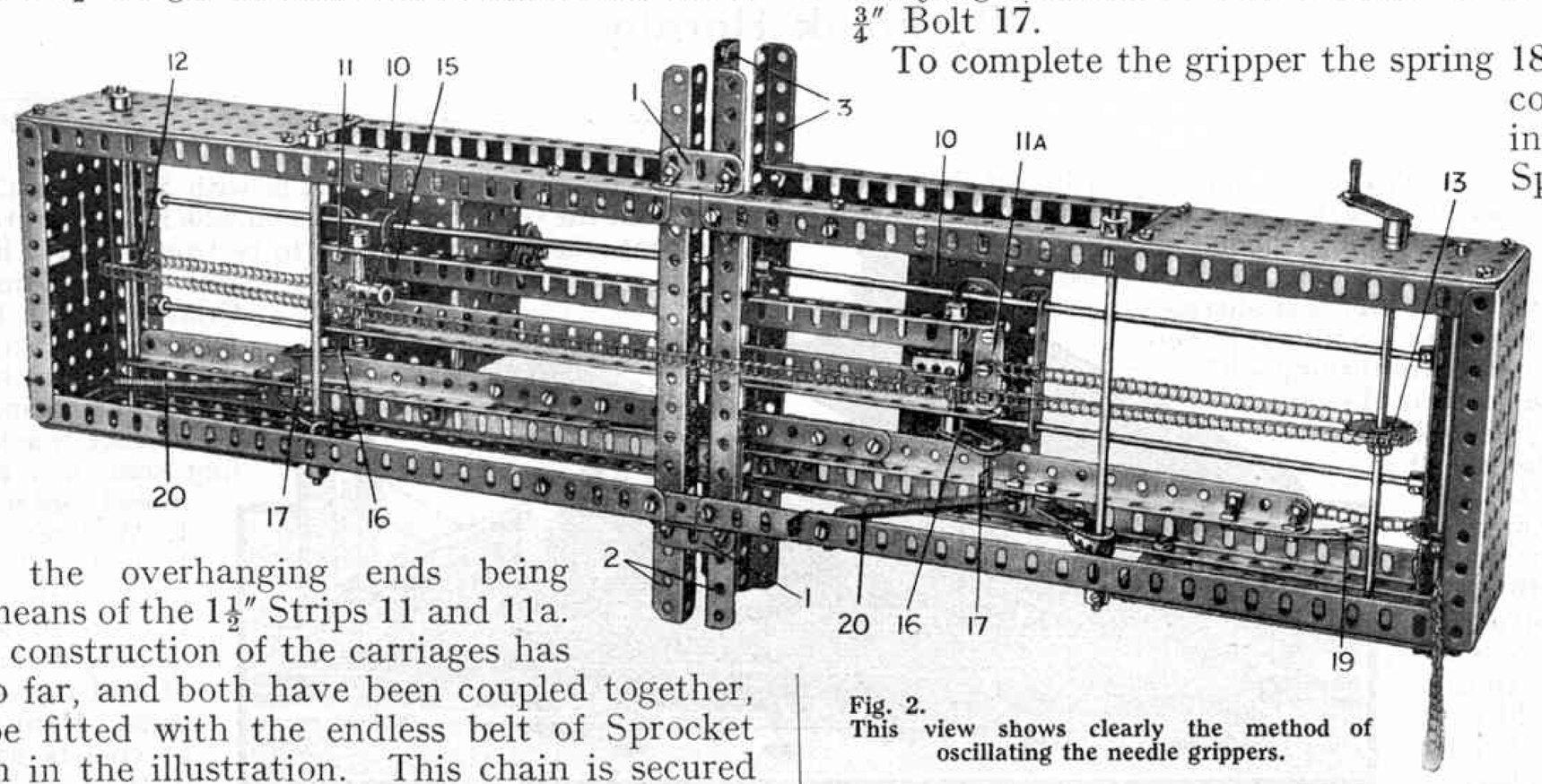


Fig. 2.
This view shows clearly the method of oscillating the needle grippers.

When the construction of the carriages has proceeded so far, and both have been coupled together, they may be fitted with the endless belt of Sprocket Chain shown in the illustration. This chain is secured at one end to the Strip 11. It then passes round the 1" Sprocket Wheel 12, carried on a $6\frac{1}{2}$" Rod, after which it passes round a second 1" Sprocket Wheel 13 and is bolted to the $1\frac{1}{2}$" Strip 11a. The Sprocket Wheel 13 is mounted on a $6\frac{1}{2}$" Rod that carries at one of its ends a crank handle built up from a Crank fitted with a Threaded Pin. Thus by operating the handle the two carriages are made to travel forward or backward, as desired.

Each of the vertical $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates, secured to the Plates 10, carries a gripper built up in two separate similar sections. Each section consists of two pairs of Flat Brackets set at 90° to each other, the separate Flat Brackets of one pair overlapping the corresponding Flat Brackets of the other pair. When the two sections of the grippers have been constructed they will be found to interlock with each other, and if they are forced together round a needle they will hold it very securely. The lower half of the gripper is attached to the vertical Flanged Plate by a $\frac{3}{8}$" Bolt and the upper half is secured to a Collar, three Washers being used for spacing purposes between the Collar and gripper. This latter Collar is carried at the top of a 3" Rod journalled in the centre hole of a $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip 14 and also in the centre of the second row of holes of the Plate 10. The lower end of the Rod carries a second Collar and this forms a surface against which a $\frac{1}{2}$" Bolt 15 works. This Bolt is carried in the threaded hole of a Coupling and is locked in place by means of a Grub Screw driven into the Coupling from the opposite side. The Coupling is mounted on a 2" Rod carrying a Crank 16 that is fitted at its end hole with a $\frac{3}{4}$" Bolt 17.

To complete the gripper the spring 18 is fitted. This consists of a two-inch length of Spring Cord attached at one end to the Collar carrying the upper half of the gripper. At the other end it is bolted to a $\frac{1}{2}" \times \frac{1}{2}"$ Angle Bracket attached to the Plate 10. This spring should exert considerable power, as it is upon this that the security of the needle in the gripper depends.

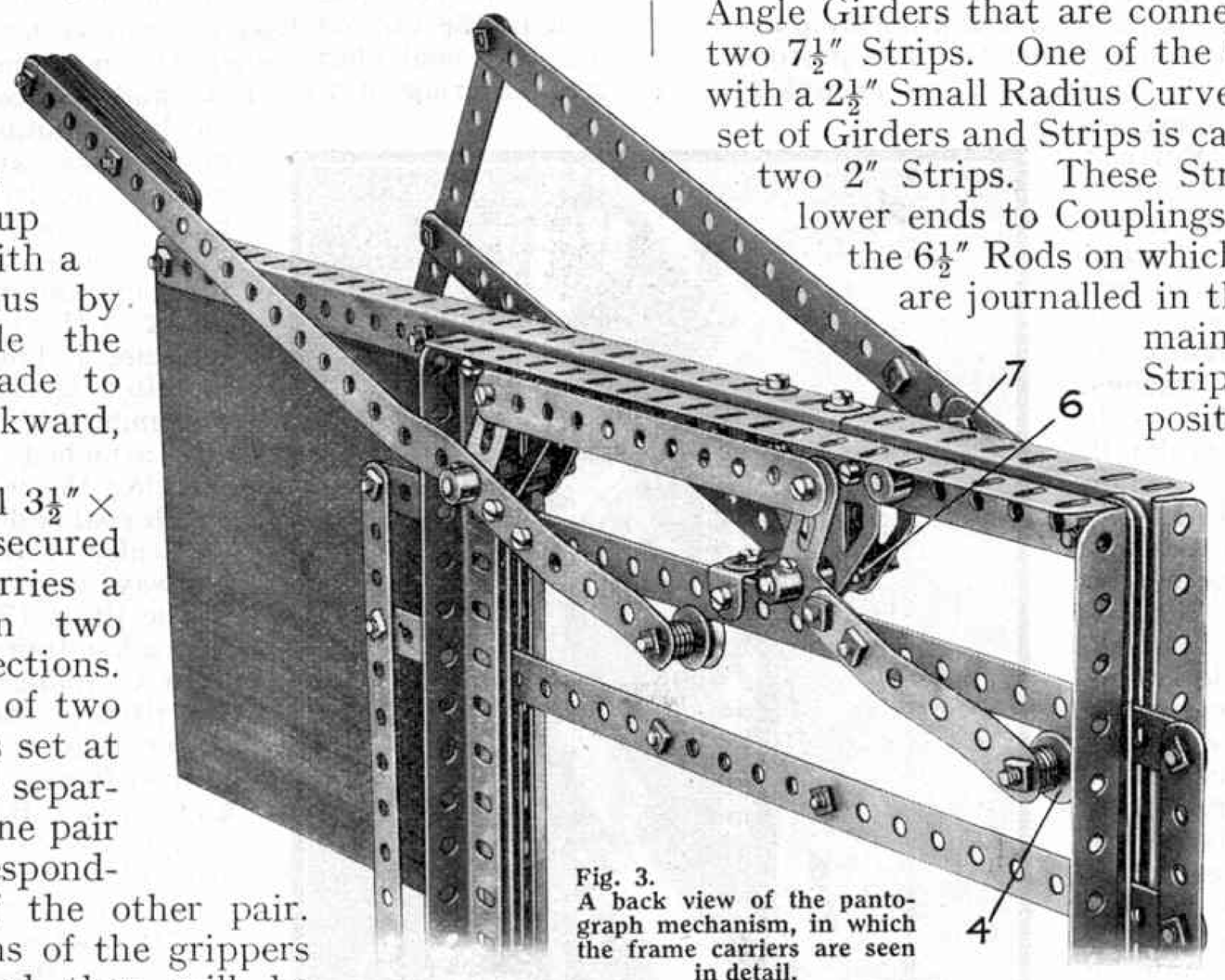


Fig. 3.
A back view of the pantograph mechanism, in which the frame carriers are seen in detail.

The $\frac{3}{4}$" Bolts 17 bear against the underside of two $9\frac{1}{2}$" Angle Girders that are connected together by means of two $7\frac{1}{2}$" Strips. One of the $9\frac{1}{2}$" Angle Girders is fitted with a $2\frac{1}{2}$" Small Radius Curved Strip 19, and the complete set of Girders and Strips is carried at two pivot points on two 2" Strips. These Strips are connected at their lower ends to Couplings by means of $\frac{1}{2}$" Bolts, and the $6\frac{1}{2}$" Rods on which these Couplings are carried are journalled in the lower set of girders of the main frames. The Girders and Strips are held in a "down" position by means of two Springs 20, thus keeping the needle grippers open. These are closed by means of the foot pedal 21 that is coupled to one of the $9\frac{1}{2}$" Angle Girders, near the Curved Strip 19, by a length of Sprocket Chain. A piece of fairly heavy material is stretched across the pantograph frame and is held in place by two Strips, sufficiently long to overlap the material one hole at each side. The needle, of the double ended embroidery type, is passed through the material and gripped alternately in the two holders. The design, which is drawn on transparent paper and placed over the squares drawn on the board, is altered by moving the pointer after every stitch, one square representing one stitch.

The parts required to construct the Embroidery Machine are as follows:

8	of No.	1	7	of No.	5	2	of No.	9b	4	of No.	13	2	of No.	35	2	of No.	52	6	of No.	63	9	of No.	111	4 of No. 133
1	„ „	1a	2	„ „	6	4	„ „	9d	5	„ „	14	173	„ „	37	1	„ „	52a	4	„ „	70	7	„ „	111a	Not included in Outfit
6	„ „	1b	2	„ „	6a	4	„ „	9f	2	„ „	16b	29	„ „	37a	4	„ „	53	1	„ „	81	6	„ „	111c	1 of No. 13
1	„ „	2	17	„ „	8	16	„ „	10	3	„ „	17	36	„ „	38	25	„ „	59	1	„ „	90a	1	„ „	115	1 piece of board
12	„ „	3	7	„ „	8a	2	„ „	12	4	„ „	18a	2	„ „	43	4	„ „	62	70"	„ „	94	4	„ „	126a	
4	„ „	4	7	„ „	9	4	„ „	12b	2	„ „	23	2	„ „	48b	1	„ „	62b	3	„ „	96	2	„ „	128	

The International Model-Building Contest

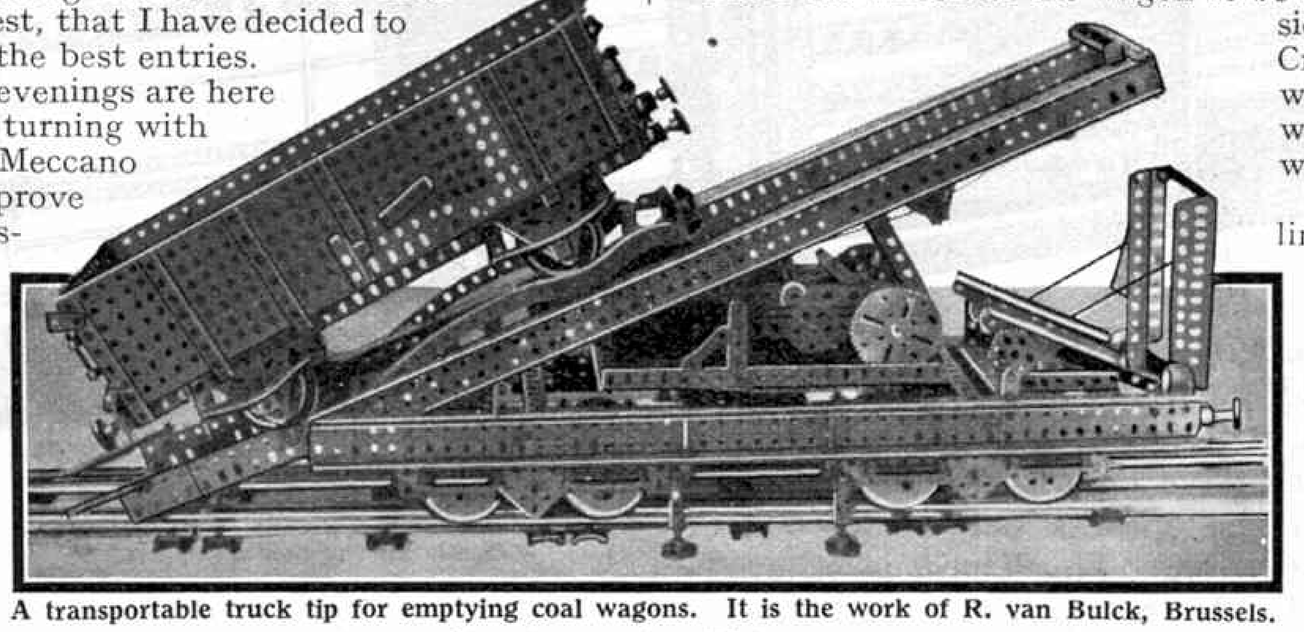
A Further Selection of Prize-Winning Models

By Frank Hornby

SO many readers have written to me expressing their keen interest in the series of articles that I have devoted to descriptions of prize-winning models in the International Model-building Contest, that I have decided to include a further selection of the best entries.

Now that the long dark evenings are here again, and model-builders are turning with renewed enthusiasm to their Meccano activities, these articles should prove specially valuable, for the illustrations and brief notes concerning original points of construction in the prize models dealt with will provide keen constructors with a host of new ideas for models of their own. Indeed it is with the sole idea of helping every model-builder to obtain the utmost pleasure from his hobby that I regularly examine the entries in Meccano Contests and describe them in these monthly articles. That they are proving helpful is evident from the encouraging letters that reach me.

This month I deal first with a unique model of a portable truck tip that won a prize for R. van Bulck, Brussels. The prototype of the model is intended for use in situations where an unloader of conventional type could not be accommodated owing to its great size. Further, a portable tipper is useful when only a few wagons are to be unloaded, and as it is readily transportable it can be attached to an ordinary train of coal wagons and taken to the destination of the coal. It is then detached from the train and brought into action for unloading the wagons.



A transportable truck tip for emptying coal wagons. It is the work of R. van Bulck, Brussels.

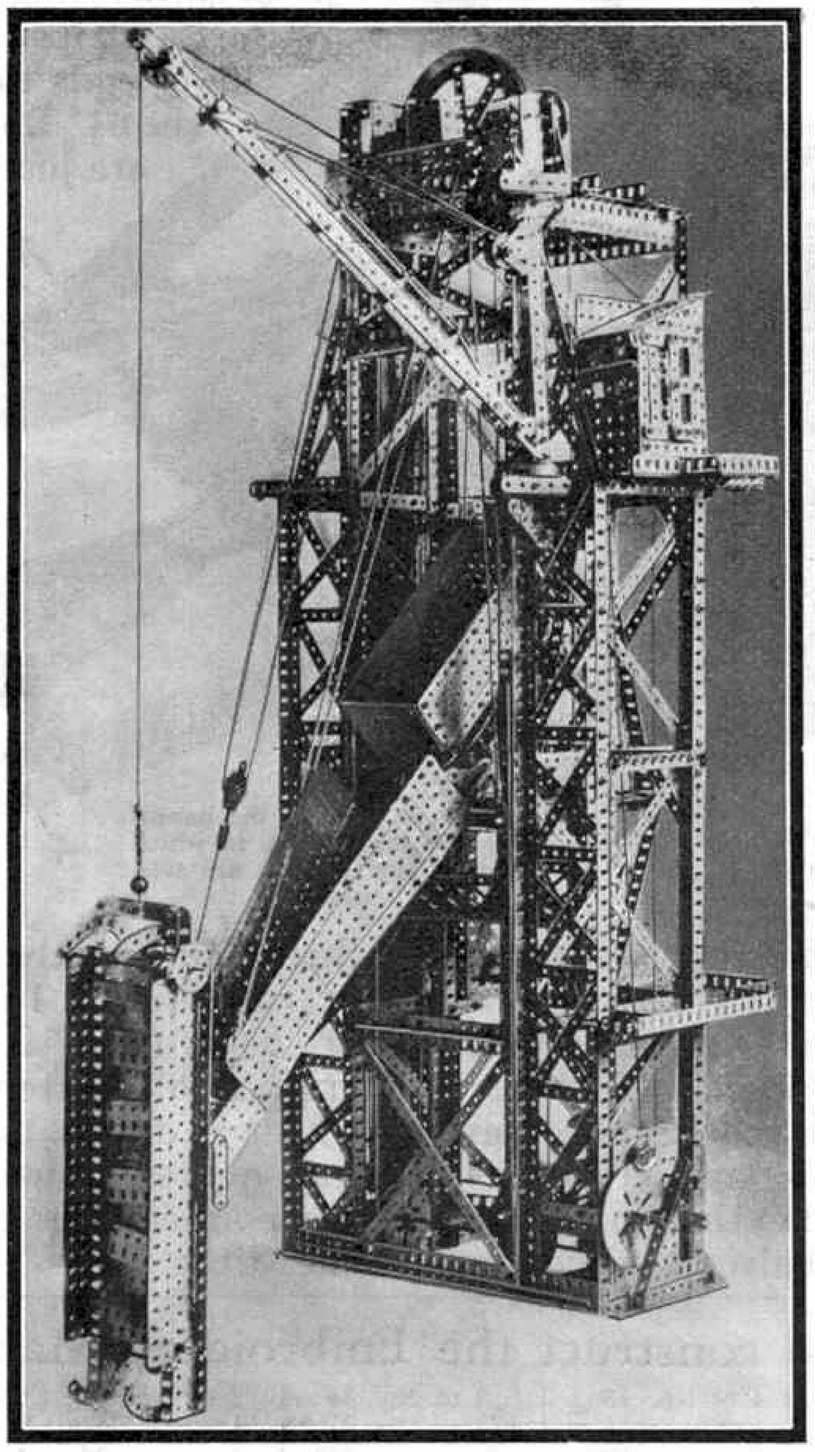
The Meccano model is built to a scale of 1″ to 1′, and is complete in every detail, including a railway wagon. The main frames are constructed from 24½″ Angle Girders and 12½″ and 5½″ Flat Girders. The two sides are connected together by means of a number of 5½″ Angle Girders, and to the centre of the frames a 5½″ × 3½″ Flat Plate strengthened with Angle Girders is bolted. Each of the two swivelling bogies is constructed from Angle Girders and is braced by four cross members, two of which are used for carrying the swivel pin. The sides of the bogie are fitted with Flat Girders and these carry the wheel springs, each of which consists of three short Strips clamped together by Bolts and secured to the bogie frame by Threaded Bosses.

Four screw jacks are fitted, two to each side of the main frames, and each of them consists of two Cranks bolted together with their respective bosses at opposite ends, one of the bosses being passed over and secured to a vertical pivot rod on the frames. The boss of the other Crank carries a Threaded Coupling in which a 1″ Threaded Rod operates. The lower end of the Threaded Rod carries a 1″ fast Pulley.

Two Architraves, fitted one on each side of an Electric Motor supported in the main frame, form the pivots for the tipping girders. These are constructed in two portions from Angle Girders and Flat Girders of various sizes, and are connected together by cross members made with 5½″ Angle Girders. When completed the Girders form rails on which a sliding trolley operates. The front wheels of the wagon to be tipped rest in hollows on each side of the sliding truck, and a Crane Grab is hitched to the wheel axle to prevent the wagon from breaking loose while it is being tipped.

Another machine for handling coal, is represented by a model submitted by Mr. L. W. Grey, Cowes, I.O.W. It is based on one of the huge coal-handling plants that are to be seen at docks loading thousands of tons of coal into the bunkers of ships. Many different types of coalers are in use, one of the best known of which is that constructed by Vickers-Armstrong Ltd., and Mr. Grey's model is a reproduction of this machine.

The actual coaler is 74′ in height, and of this 18′ are sunk into a well in the ground that accommodates the main gear-boxes and also the coal chute when the machine is not in use. Raising and lowering of the chute and the coal truck-tipper is carried out by hydraulic rams, and the subsidiary movements are operated by electric motors, the drive from these being transmitted through separate gear-boxes.



This automatic coaling plant won a prize for L. W. Grey, Cowes, I.O.W. It is fitted with a patent anti-breakage box for preventing the coal from being broken during loading.

The frame of the model accommodates the cage and the tip that raises, lowers and tips the coal wagons. The floor of the cage is hinged at the front and can be tilted by means of a ram acting on the underside. The coal chute is pivotally attached at its base to the cage carrying the wagon tip, and the rate at which coal is discharged is regulated by a vertically sliding door situated about midway down the chute.

The jib is 17″ long, and along the top runs a handrail carried in supports formed from Couplings and Handrail Supports. The jib is pivoted to the base of a vertical girder that is free to turn in bearings formed from a Ball Race at its lower end and a Pivot Bolt at its upper end. The movements of hoisting, luffing and swivelling are carried out from a gear-box at the base of the model, and the controls are situated in a small cabin at the rear.

I have already mentioned that the actual machine is fitted with two hydraulic rams, one of which operates the truck cage and the other the tip. In the model link mechanism replaces the hydraulic movement, and consists of Rack Strips bolted to the rams and actuated by 1″ Gear Wheels. The cage is raised or lowered by increasing or decreasing the length of the ram stroke.

In actual practice it is frequently necessary to coal ships with very deep holds, and unless special precautions were taken the coal would be smashed into small pieces and considerable loss would occur owing to the large quantities of coal dust produced. In order to overcome this difficulty an attachment termed an anti-breakage box is often fitted to the

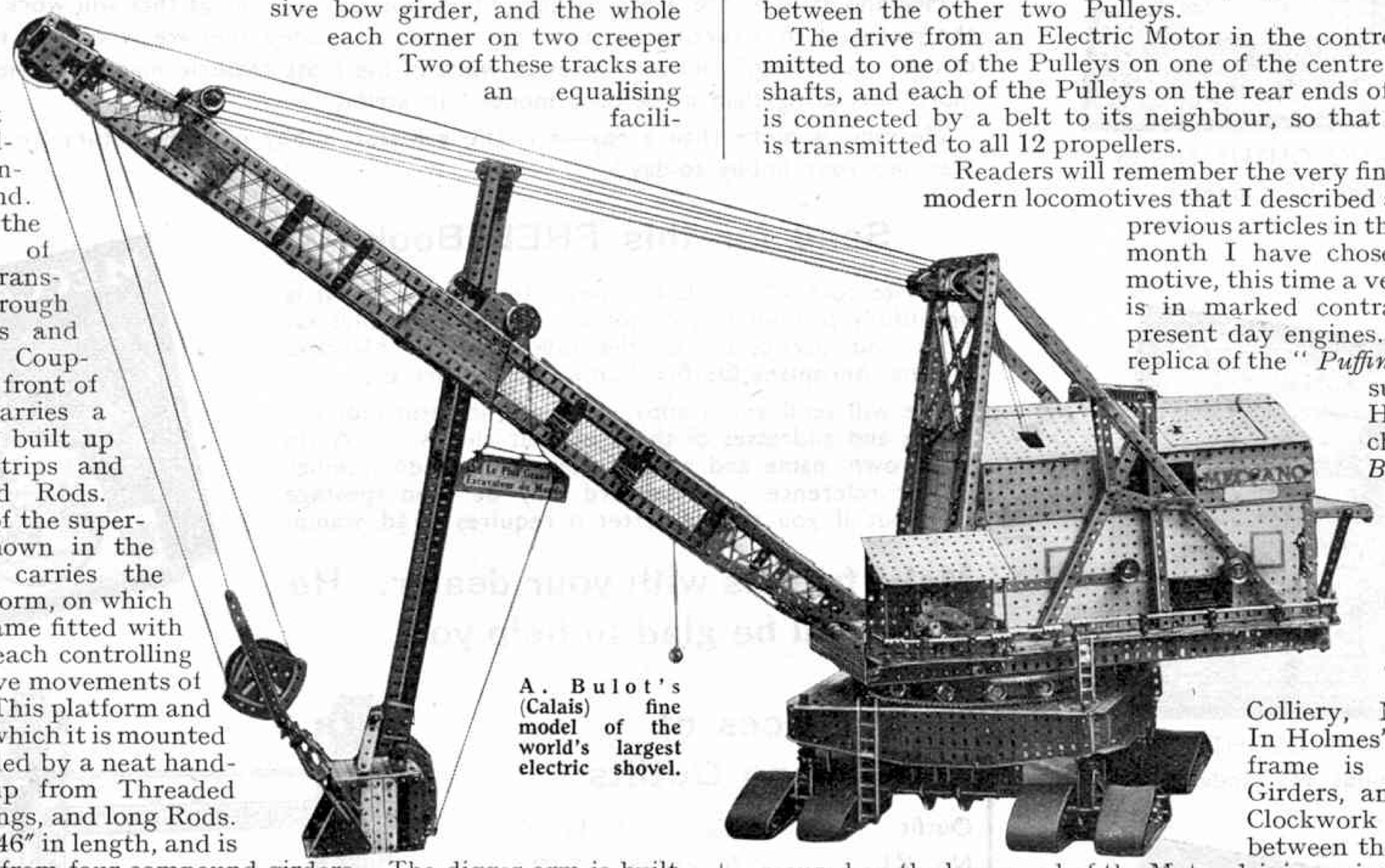
end of the coaling chute. In the model described here this has been reproduced with considerable success. As the coal enters the box it falls on to a flap, and its weight causes an endless belt to rotate and so pass the coal safely to the bottom of the hold. During the flap's journey other flaps on the belt have been loaded, and in this manner the continual stream of coal down the chute is dealt with.

I come now to a model of considerable interest that was sent by a French competitor, A. Bulot of Calais. It is an electric shovel excavator, and its prototype has the distinction of being the largest shovel of its kind in the world. This wonderful machine was fully described and illustrated in the *"M.M."* for December, 1930.

The main platform or base of the model is $12\frac{1}{2}''$ square, each side being constructed in the shape of a massive bow girder, and the whole is carried at each corner on two creeper truck units. Two of these tracks are mounted on an equalising beam that facilitates travelling over uneven ground. The drive to the four sets of creepers is transmitted through Bevel Gears and Universal Couplings. The front of the base carries a short ladder built up from $5\frac{1}{2}''$ Strips and $1''$ Threaded Rods.

The side of the superstructure shown in the photograph carries the control platform, on which is a lever frame fitted with five levers, each controlling one of the five movements of the model. This platform and the base on which it is mounted are surrounded by a neat handrail built up from Threaded Pins, Couplings, and long Rods.

The jib is 46" in length, and is constructed from four compound girders. The digger arm is built up from four $24\frac{1}{2}''$ Angle Girders, and the construction of the bucket, which is a very fine replica of the original, is shown clearly in the illustration.



A. Bulot's (Calais) fine model of the world's largest electric shovel.

The racking movement for the bucket arm is driven through Universal Couplings from the main shaft of the gear-box, and is carried out by a $3\frac{1}{2}''$ Rod carrying two $\frac{1}{2}''$ Pinions that mesh with Rack Strips secured to the bucket arm.

J. Willems, of Hoboken, Antwerp, chose the giant Do.X. Flying Boat as the subject for his model, which is shown here. It will be seen that each side of the fuselage is built up from Flat Girders and Strips, the bow being formed from $4\frac{1}{2}''$, $3\frac{1}{2}''$ and $1\frac{1}{2}''$ Strips. The top is covered in at the front by means of $12\frac{1}{2}''$ Strips, and at the rear by similar Strips and Flanged Sector Plates. The rudder consists of a vertical $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate, the edges of which are fitted with $5\frac{1}{2}''$ and $2\frac{1}{2}''$ Curved Strips as shown in the illustration. To this Plate are secured $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates representing the tail planes, and two bracing members secured to the underside of these are attached by means of Angle Brackets to the rear of the fuselage.

A fine effect has been obtained in this model Do.X. Flying Boat by setting the propellers in motion while the photograph was taken. The model is the work of J. Willems, Antwerp.

The main plane consists of Flat Plates on both its under and its upper side, and these are bolted to a framework of Strips, the leading edge being streamlined with the aid of Strips, bolted together in long lengths.

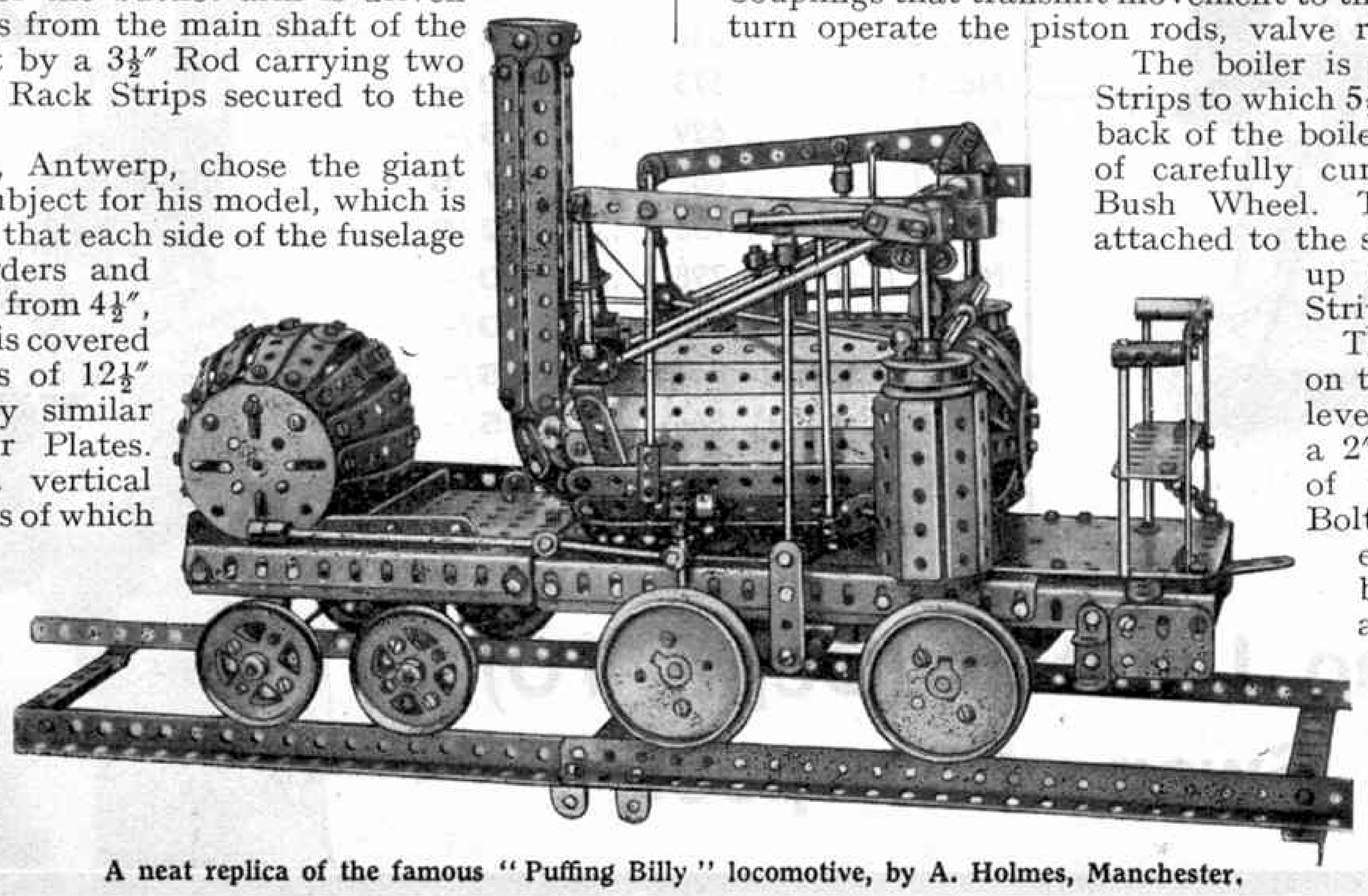
The upper face of the wing carries six engine housings, each of which is constructed from two $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates secured together at their flanges by means of four $1\frac{1}{2}''$ Strips, the spaces between them being filled in by $3\frac{1}{2}''$ Strips. The top of the housing consists of three $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips bolted to two Bush Wheels, the bosses of which serve as bearings for the propeller shafts, which carry a $1''$ fast Pulley at one end and two similar Pulleys at the other end. The front propeller is placed on the Rod against the Pulley and is clamped in position by a Collar. The rear propeller is held on the Rod between the other two Pulleys.

The drive from an Electric Motor in the control cabin is transmitted to one of the Pulleys on one of the centre pair of propeller shafts, and each of the Pulleys on the rear ends of the other shafts is connected by a belt to its neighbour, so that the Motor drive is transmitted to all 12 propellers.

Readers will remember the very fine models of giant modern locomotives that I described and illustrated in previous articles in this series, and this month I have chosen another locomotive, this time a very early one that is in marked contrast to the huge present day engines. The model is a replica of the *"Puffing Billy"* and was submitted by A. Holmes, Manchester. *"Puffing Billy"* was one of the earliest steam locomotives, and was built by William Hedley in 1813 for work at the Wylam Colliery, Northumberland. In Holmes' model the main frame is built of Angle Girders, and at the rear a Clockwork Motor is fitted between them. A $\frac{1}{2}''$ Pinion secured on the lower end of the Motor driving spindle meshes with a $\frac{3}{4}''$ Contrate Wheel on a horizontal Axle Rod, which also carries a $\frac{1}{2}''$ Pinion. This Pinion engages a $1\frac{1}{2}''$ Contrate on a Rod placed across the frame between the driving wheels, and on this Rod are two Couplings that transmit movement to the overhead beams, which in turn operate the piston rods, valve rods and the water pump.

The boiler is made from two circles of Strips to which $5\frac{1}{2}''$ Strips are bolted, and the back of the boiler is finished off by the use of carefully curved Strips secured to a Bush Wheel. The cylinders, which are attached to the side of the boiler, are made up of $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips bolted to Bush Wheels.

The safety valve mounted on the boiler is of the weighted lever type, the lever being a $2''$ Screwed Rod at one end of which is secured a $\frac{3}{4}''$ Bolt. A Collar on the lower end of the Bolt is pivoted between Angle Brackets attached to the boiler, and a second Collar on the $2''$ Screwed Rod rests on a Coupling fitted vertically to the boiler. The water barrel is built up from Strips bolted to Face Plates.



A neat replica of the famous "Puffing Billy" locomotive, by A. Holmes, Manchester.

MECCANO

MECCANO OUTFIT No. O
Builds 343 Models

MECCANO OUTFIT No. 1
Builds 573 Models

MECCANO OUTFIT No. 4
Builds 753 Models

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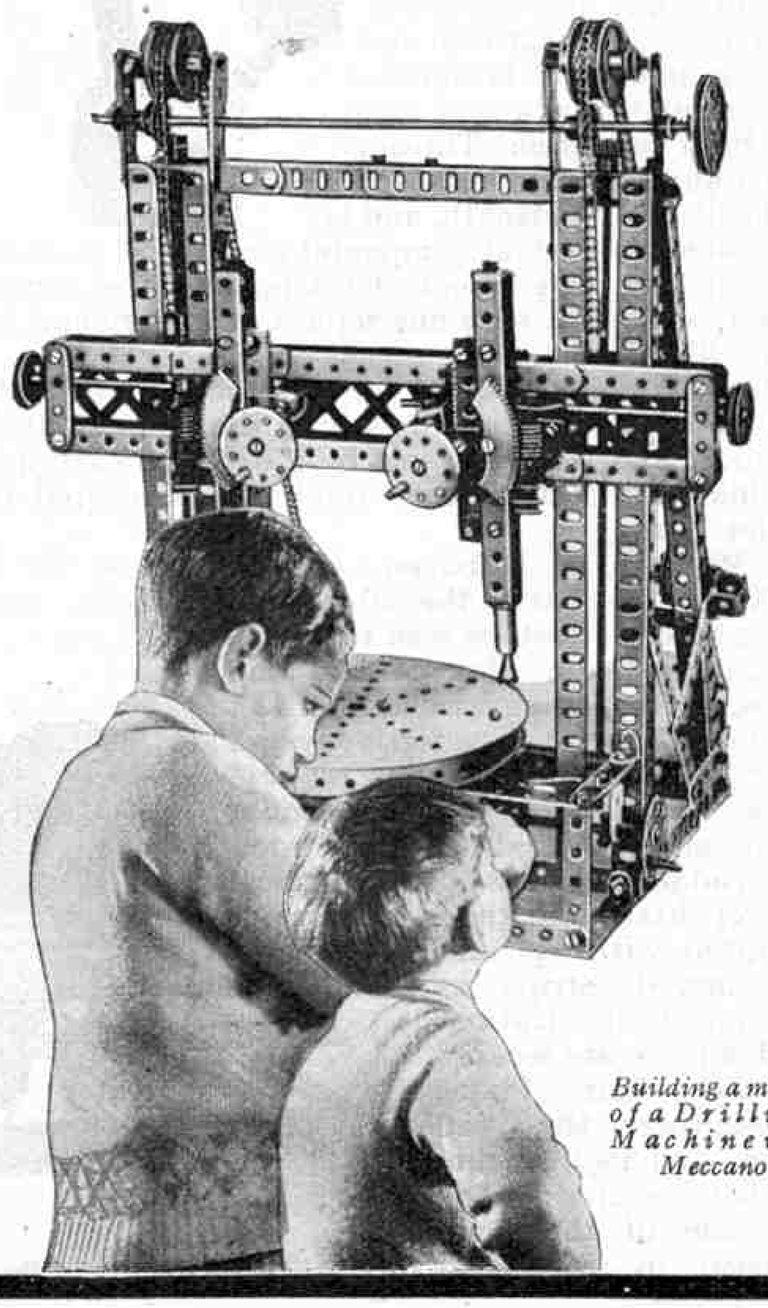
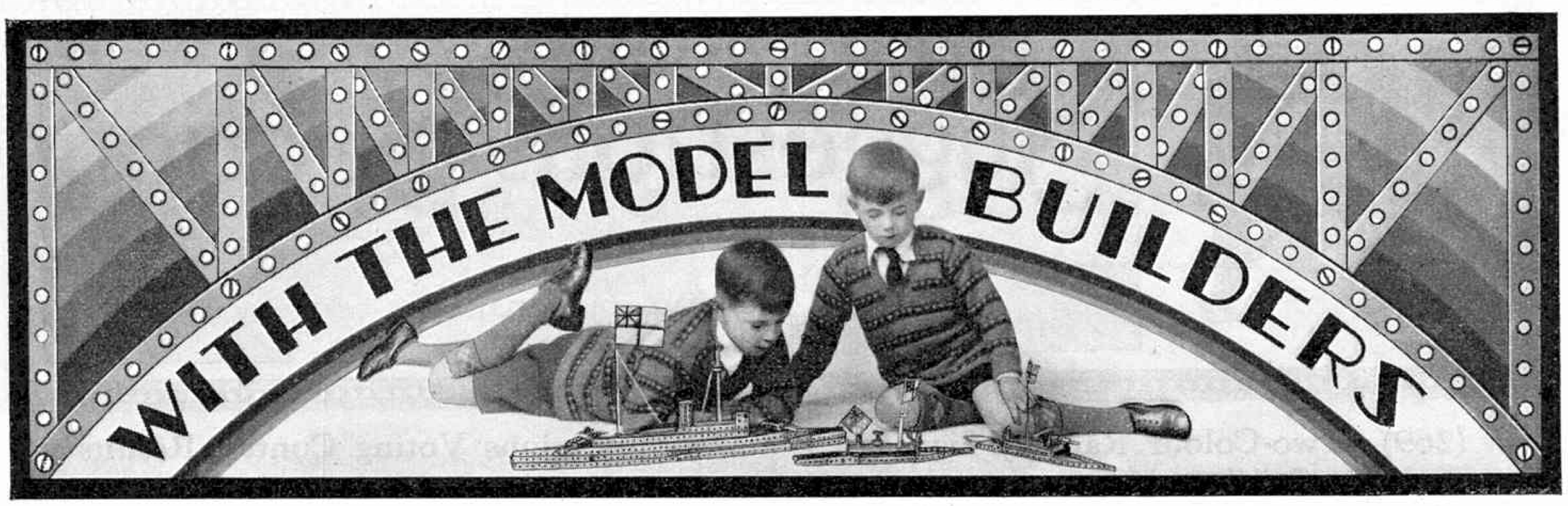
Prices of Meccano Outfits

Outfit	Builds	Price
No. X1	70 models	1/3
No. X2	96 ,,	2/-
No. OOO ...	162 ,,	2/6
No. OO	189 ,,	3/6
No. O	343 ,,	5/-
No. 1	573 ,,	10/-
No. 2	629 ,,	16/-
No. 3	687 ,,	27/6
No. 4	753 ,,	52/6
No. 5 (Carton)	798 ,,	70/-
No. 5 (Cabinet)	798 ,,	100/-
No. 6 (Carton)	844 ,,	125/-
No. 6 (Cabinet)	844 ,,	155/-
No. 7 (Cabinet)	889 ,,	450/-



Building a model of a Drilling Machine with Meccano

Meccano Limited (Dept. 70)
Old Swan - Liverpool



A USEFUL GEAR ACTION

Most Meccano boys will be familiar with worm and pinion gearing whereby a big speed reduction may be obtained. A worm gear assembly may be built up from a Meccano Worm (part No. 32) meshed with a Meccano Pinion or Gear Wheel, and ratios of from 19 to 133 : 1 may be obtained in this way. Many instances of the application of worm gearing in Meccano will be found in the Manuals and the Meccano Super Model Instruction Leaflets.

Owing to the special shape of the teeth of the Meccano Gears and Pinions, and the design of the threads of the Worm, worm gearing in Meccano is of the "non-reversible" type. This means that the Worm can be rotated so as to drive the Gear Wheel or Pinion, but the Gear Wheel cannot be used to rotate the Worm, as the teeth of the Gear lock against the threads of the Worm. In actual engineering, worm gearing of both the reversible and non-reversible types is used, and each has special advantages. When a worm and wheel mechanism is required for a motor teering gear, for instance, it is an advantage to have a gear of the non-reversible type, as with a reversible gear every slight movement and twist of the front wheels would be transmitted to the driver's arms through the steering wheel and the car would be difficult to control.

In Meccano engineering the non-reversible worm gearing will be found suitable in the great majority of models and mechanisms. By varying the method of mounting the Worm and Pinion or Gear Wheel it is possible to construct a neat form of rack or pinion mechanism that will be found useful when it is required to convert rotary to linear motion and vice versa. The Worm is mounted on a Rod that is free to slide in suitable bearings and the threads of the Worm are engaged with a ½" Pinion. When the Rod carrying the Worm is moved backward or forward, by means of a lever, etc., the threads of the Worm engage with the teeth of the ½" Pinion and cause it to rotate. This action can of course be carried out by making use of the standard Meccano Rack Strip, but the gear formed in this way is not as compact.

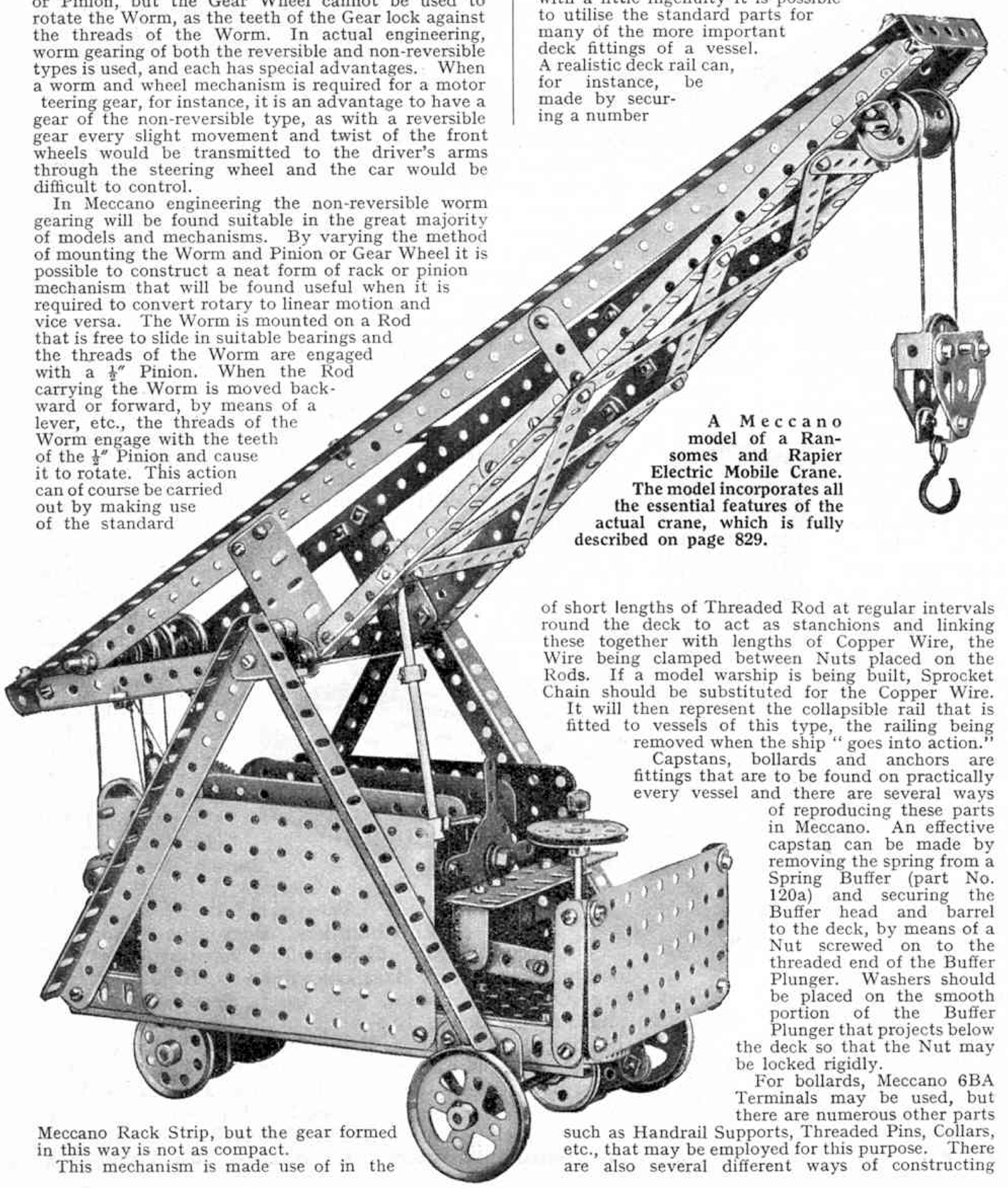
This mechanism is made use of in the Electric Indicating Sign that was described in the November 1929 "Suggestions Section."

SHIPS FITTINGS IN MECCANO

Model shipbuilding in Meccano is particularly fascinating, and many splendid examples of this class of work have been produced from time to time. Model battleships, passenger and cargo ships, ferry steamers, yachts, motor boats, and many other different types of craft can be constructed.

One of the great charms of ship models is the detail work such as the deck and super-structure fittings, rigging, etc., and these details add considerably to the complete effect.

A range of special model ship fittings is not at present contained in the Meccano system, but with a little ingenuity it is possible to utilise the standard parts for many of the more important deck fittings of a vessel. A realistic deck rail can, for instance, be made by securing a number of short lengths of Threaded Rod at regular intervals round the deck to act as stanchions and linking these together with lengths of Copper Wire, the Wire being clamped between Nuts placed on the Rods. If a model warship is being built, Sprocket Chain should be substituted for the Copper Wire. It will then represent the collapsible rail that is fitted to vessels of this type, the railing being removed when the ship "goes into action."



A Meccano model of a Ransomes and Rapier Electric Mobile Crane. The model incorporates all the essential features of the actual crane, which is fully described on page 829.

Capstans, bollards and anchors are fittings that are to be found on practically every vessel and there are several ways of reproducing these parts in Meccano. An effective capstan can be made by removing the spring from a Spring Buffer (part No. 120a) and securing the Buffer head and barrel to the deck, by means of a Nut screwed on to the threaded end of the Buffer Plunger. Washers should be placed on the smooth portion of the Buffer Plunger that projects below the deck so that the Nut may be locked rigidly.

For bollards, Meccano 6BA Terminals may be used, but there are numerous other parts such as Handrail Supports, Threaded Pins, Collars, etc., that may be employed for this purpose. There are also several different ways of constructing realistic anchors for model vessels. A model anchor of the heavy naval pattern can be formed from a Coupling fitted with a 1" Rod and carrying a Flat Bracket at each end to represent the "flukes."

Lifeboats and their accompanying launching gear are another important deck feature. Strips suitably bent may be used for constructing the boats, while the davits may be either Curved Strips or lengths of heavy Copper Wire bent to shape, the lifeboats being suspended by short lengths of Cord. A few life-belts are generally to be found on the deck of a vessel, and here the Meccano §" Rubber Ring (part No. 155) comes in very useful. The Ring should be bound with Meccano Cord so as to have a close resemblance to the actual article.

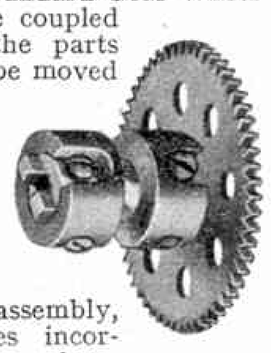
In building models of fighting ships, the armament and other military equipment is of primary importance. The heavy guns with their accompanying turrets can be constructed quite easily from standard Plates, Strips and Axle Rods. A small quick-firing gun may be built from a short Axle Rod fitted to a stand composed of a Coupling that is free to swivel, a gun shield consisting of a Flat Trunnion being placed in front of the Coupling. Anti-aircraft and Maxim guns may also be represented with standard parts. Anti-aircraft type may consist of a Rod mounted in a Coupling that in turn is supported in a framework that is free to swivel in a vertical plane. A Rail Adaptor (part No. 173) makes an excellent Maxim gun. The Adaptor is mounted on the deck by means of an Angle Bracket and an Angle Bracket is also secured at each side to act as a gun shield.

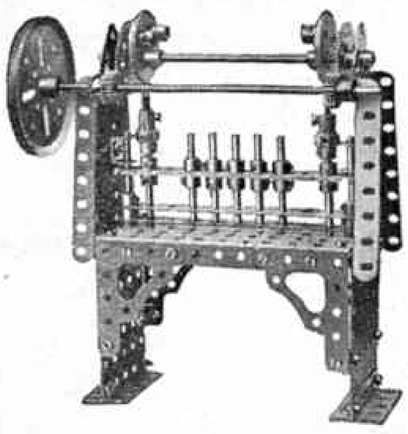
From this it will be seen that the construction of model ship fittings in Meccano presents great possibilities, and we shall be interested to hear from readers who have devised novel uses for the parts in this connection.

THE FLOAT TIE ROD

Model-builders will note that several additions have now been made to the Meccano Aeroplane Constructor Parts, and many of the existing parts have been modified so as to possess a more attractive appearance. Among the new parts, the Float Tie Rods that are designed to be connected between the Floats in Aeroplane models to act as bracing members are of particular interest to the general model-builder, as these parts may be applied in any standard Meccano model where tie bracing is required. The main portion of the Tie Rod is a strip of steel approximately ⅛" wide, each end of which is formed into a perforated lug. The holes in the lugs are 4" apart, and the Tie Rod therefore will fit in with the standard ½" spacing of the Meccano system. Numerous instances are found where Tie members are required in order to strengthen or brace a framework, and part No. P57 will be found particularly suitable for this purpose, as it is much easier to fit in position than bracings of a similar size made from wire, etc.

"DOGGED" GEARS. We have inspected your suggestion regarding a range of special gears having one section of a Dog Clutch formed in their bosses. This idea received our consideration some time ago and our solution to the problem of providing a "dogged" gear is to be found in the Socket Coupling (part No. 171). As shown in the accompanying illustration, this part enables a standard Gear Wheel and a Dog Clutch Section to be coupled together while the groove in the parts allows the complete gear unit to be moved up and down on the Rod by means of a "selector" lever, which may consist of a Rod, Strip, etc. A complete "dogged" gear unit formed in this way is not, of course, as compact as a specially produced gear, but this is not found to be a serious drawback to the gear-box assembly, and several compact gear-boxes incorporating this construction have been produced. The Socket Coupling assembly, on the other hand, possesses great adaptability. It is possible to secure any Gear Wheel or Pinion to the Coupling in place of the 57-teeth Gear Wheel shown, and by this means various gear ratios can be produced. (*Reply to J. Shipman, Bristol.*)





Suggestions Section

Edited by "Spanner"

(269)—Two-Colour Railway Signal

(David Simpson, Edinburgh)

The outstanding feature of the self-contained two-colour signal shown below is the ingenious method of holding the battery. A small pocket lamp battery is housed between two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates that carry the switch gear and form a base for the model. This arrangement will be found very suitable in numerous instances where it is required to use a small battery for lighting purposes, etc. In Fig. 269 a two-colour railway signal is shown mounted on the plates, and this will make an interesting addition to a Hornby Railway System. The entire railway could be fitted with a complete set of signals of this type and much fun could be had from running trains at night.

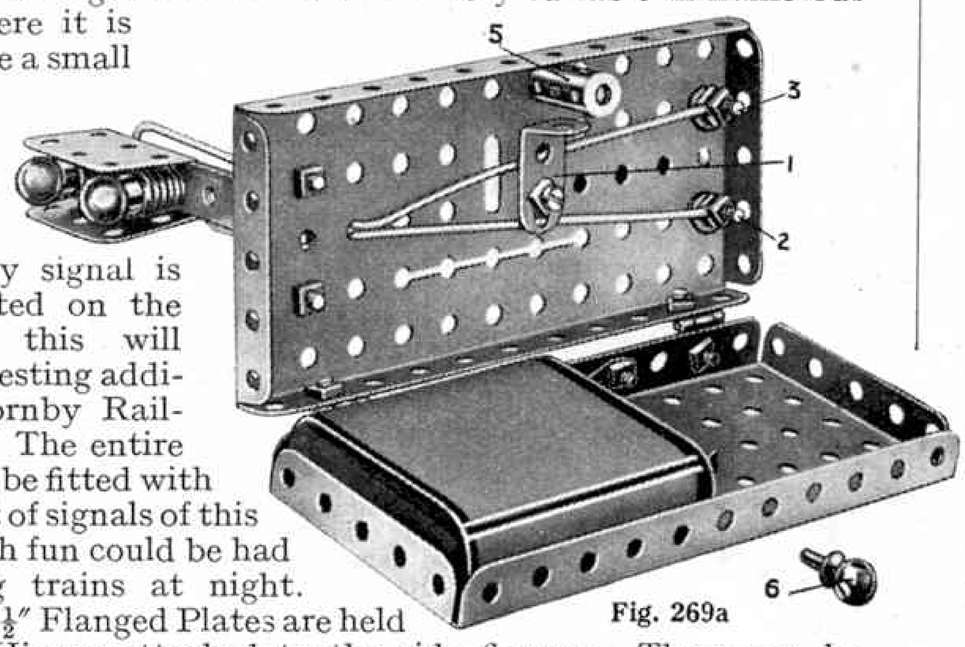


Fig. 269a

Two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates are held together by Hinges attached to the side flanges. These can be seen in Fig. 269a, which shows the inside of the box and the electrical connections. A standard size flat pocket lamp battery fits exactly between the flanges of the lower Plate, and one of the brass strips of the battery is bolted to the Plate to make good contact with the metal. It may be found necessary to scrape off a little of the enamel to ensure good contact. The upper Plate carries on the inside a $1'' \times \frac{1}{2}''$ Angle Bracket fixed on a 6 B.A. Bolt. The Angle Bracket is in metallic contact with the Bolt but should be insulated from the Plate, and the Bolt carries an Insulating Bush and Washer for this purpose. A Nut on the shank of the Bolt on the upper side of the Plate holds the Bracket firmly in position, and the Strip 4 is placed over this. Two Nuts locked together allow free movement of the Strip that forms the switch arm and carries a Threaded Boss for a handle. The switch is shown in the "off" position, and on each side is a 6 B.A. Bolt insulated from the Plate, so that on moving the switch arm to either side it makes contact with one of the Bolt heads.

When the lid is closed, the Angle Bracket 1 should make contact with the second brass strip on the battery, and the handrail support 6 is passed through one of the holes in the Plate and threaded into the end tapped bore of the Coupling 5. This Coupling is attached to the upper Flanged Plate by means of a bolt passed through the Plate and gripped in the longitudinal bore of the Coupling.

The signal lamps are mounted in Lamp Holders fixed in position in a Channel Bearing. The 6 B.A. Bolts holding the Lamp Holders in position pass through a pair of $3\frac{1}{2}''$ Strips and the Channel Bearing, and are fitted on the outside with Insulating Bushes, the bushes of which fit into the end perforations of the Bearing. To prevent the Channel Bearing from slipping down and allowing the 6 B.A. Bolts to foul the $3\frac{1}{2}''$ Strips, a nut and bolt hold it firmly in position. These should be secured together before the 6 B.A. Bolts are inserted in place. The Strips forming the vertical member of the signal are held to the base by a Trunnion.

A length of insulated wire connects the upper lamp to the Bolt 3, and the lower lamp is connected to the Bolt 2. The current from the battery goes through the Angle Bracket 1 to the switch arm, and on moving the latter to right or left, contact is made with one of the Bolts 2 or 3, causing one of the lamps to light up.

Suggestions Voting Contest Results

The results are now available of the Voting Contest organised to ascertain which were the most popular suggestions published during 1931, and it is interesting to note that the opinions of Home and Overseas readers closely coincide. Entries received for the two sections were treated separately, and every vote was recorded according to its position on the competitor's list. At the close of the Contest, the points alloted to each model in each section were totalled up and compared.

Both Home and Overseas readers voted Suggestion No. 231, "A Meccano Front Wheel Drive" the best, and second best in both sections was No. 244, "An Exciting Race Game." The "Demonstration model of a Single Plate Clutch" (No. 211) occupied third position in the Home section voting, and in the Overseas section No. 240, "Demonstration Model of a Range Finder" was voted third. The fourth popular suggestion in both sections was No. 234, "Interesting Motor Testing Mechanism." Incidentally the third most popular model in the Home Section was a close runner-up in the Overseas section and vice-versa, so it will be seen that there is little difference of opinion between Meccano boys throughout the world.

The final list of most popular suggestions is noteworthy as it shows the chief interests of "*M.M.*" readers. Motor cars are always popular subjects with Meccano enthusiasts, and therefore it is not surprising that models of the latest car improvements should be strongly in favour. The adoption by certain car manufacturers of front wheel drive has been followed with great interest by "*M.M.*" readers, many of whom have constructed models on similar lines. The front wheel drive device submitted by R. W. Blake, Twickenham, was unanimously proclaimed, by both Home and Overseas readers, the best suggestion published, and Blake has been awarded the prize of Meccano products to the value of half-a-guinea. Prizes have been awarded also to the senders of the other suggestions appearing in the results of the voting.

No competitor sent in an all-correct list, so the prize of half-a-guinea has been awarded to the nearest correct according to the number of points. In the Home section two competitors' lists were awarded the same number of points, and therefore the prize of half-a-guinea has been divided between S. G. Smith, Forest Gate, London, E.7, and W. F. L. Clement, Willington, Co. Durham. Twelve prizes of Meccano Engineer's Pocket Books have been awarded to the following competitors in the Home Section: R. Bennett, Ladywood, Birmingham; L. Copeland, London, S.E.24; E. Margerison, Little Harwood, Blackburn; W. Crichton, Glasgow, E.1; E. Samuel, Wrexham; W. Scott, Belfast; W. Chambers, Burton-on-Trent; G. Wild, Wigan; C. Wrayford, Newton Abbot; K. Costain, Bolton; K. Bak, Leicester; D. Brooks, Bristol.

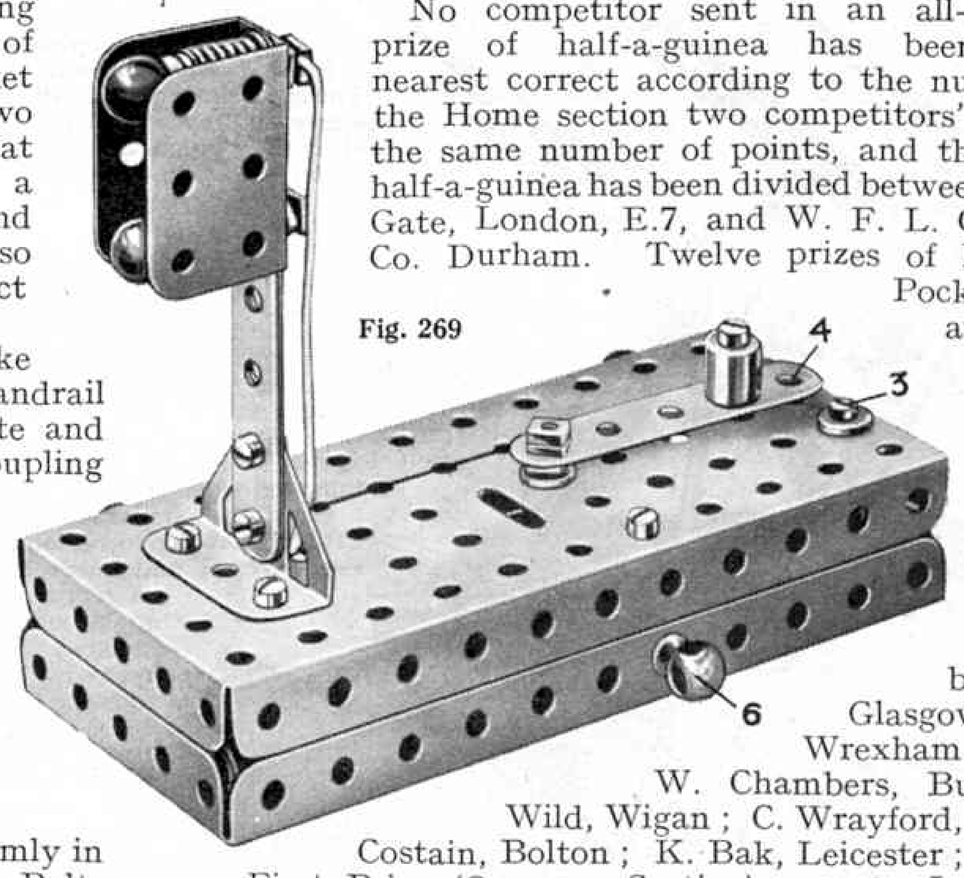


Fig. 269

First Prize (Overseas Section) goes to J. Degol, Schaerbeck, Belgium, and Pocket Books to:—

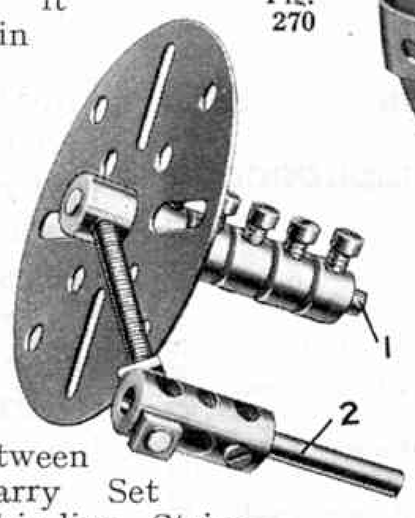
Miss N. Bedlington, Takupuna, N.Z.; D. White, Dunedin, N.Z.; R. Burbery, Lyttelton, N.Z.; J. Gomes, Bandra, Bombay, India; A. Thurber, Calgary, Alberta, Canada; R. Garcia, Trinidad, B.W.I.; A. Dickie, Mataura, N.Z.; Miss M. Dias, Bandra, Bombay, India; R. Russell, Whangarei, N.Z.; K. Dick, Matraville, Australia; B. Richards, Warburton, Australia; C. Wallace, Sea Point, S.A.

(270) Combination Padlock

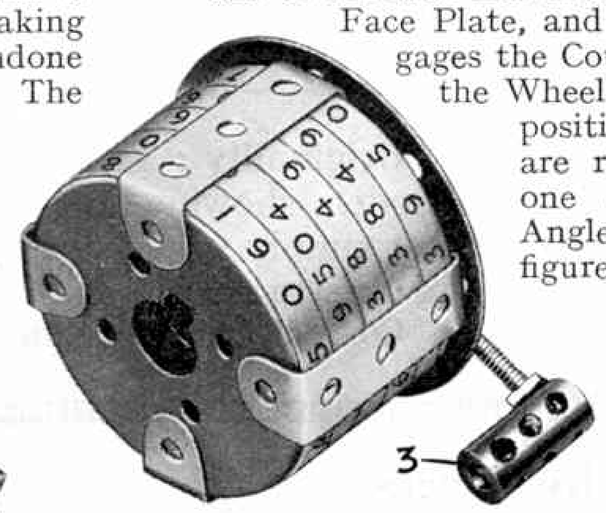
(E. Heneage, Harrogate)

The device consists of two parts, which are shown separately in the illustration. Four $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, bolted in the radial slots of a Face Plate, hold in position five Wheel Flanges. The bolt heads are on the outside of the Face Plate and a second nut is threaded on each Bolt, making it impossible for the Bolts to be undone when the lock is assembled. The Wheel Flanges are inserted by bending one of the Double Angle Strips outward and replacing it when they are in position. A 2" Screwed Rod is fitted in the Boss of the Face Plate and carries the Coupling 3. Five Collars are fixed on the Rod 1 with a small space between each, and carry Set Screws arranged in line. Strips of paper are gummed round the edges of the Wheel Flanges, and numerals or letters marked on each strip.

Fig. 270



The cut-away portions in the centres of the Wheel Flanges, when arranged in line, allow the Set Screws in the Collars on the Rod 1 to pass through unimpeded. The end of the Rod fits into the boss of the Face Plate, and the Rod 2 engages the Coupling 3. With the Wheel Flanges in this position the numbers are read off against one of the Double Angle Strips. If figures are employed it will be necessary to take the readings against two different Double Angle Strips, as each Wheel Flange has two sets of numbers 0 to 9.



As soon as any one of the Wheel Flanges is rotated, the withdrawal of the Collars on the Rod 1 is prevented until all the cut-away portions of the Wheel Flanges are again in line, so allowing a free passage for the Set Screws.

(271) Double-Acting Feed

(R. Beauchamp, Poitiers, France)

An ingenious double-acting ratchet feed device is shown in Fig. 271. This imparts rotary movement to the Sprocket Wheels on both the forward and return strokes, the Wheels being stationary only when the driving Crank passes the "dead centres." The mechanism can be used for driving a conveyor where a slight periodic pause is required, and it may be used in certain cases instead of the more usual form of Ratchet Gearing.

The Rod carrying the Crank 1 is journalled in Flat Brackets bolted across the elongated holes of two simple Bell Cranks, and carries in addition a $\frac{1}{2}''$ Pinion and a Collar. The Eye Piece 3 is securely held on a Threaded Pin and in it a $3\frac{1}{2}''$ Strip is free to slide. A Rack Strip is secured to the Strip, but spaced from it by Washers; and at each end a $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is fixed. The Pawls 4 are mounted on Pivot Bolts passed through the Rack Strip, and the heads of the Bolts are placed between the $3\frac{1}{2}''$ Strips and Rack Strip so that they do not foul the Eye Piece 3. A length of Spring Cord is attached to the Pawls to hold them in position in the chain that passes round the Sprockets at each end of the frame.

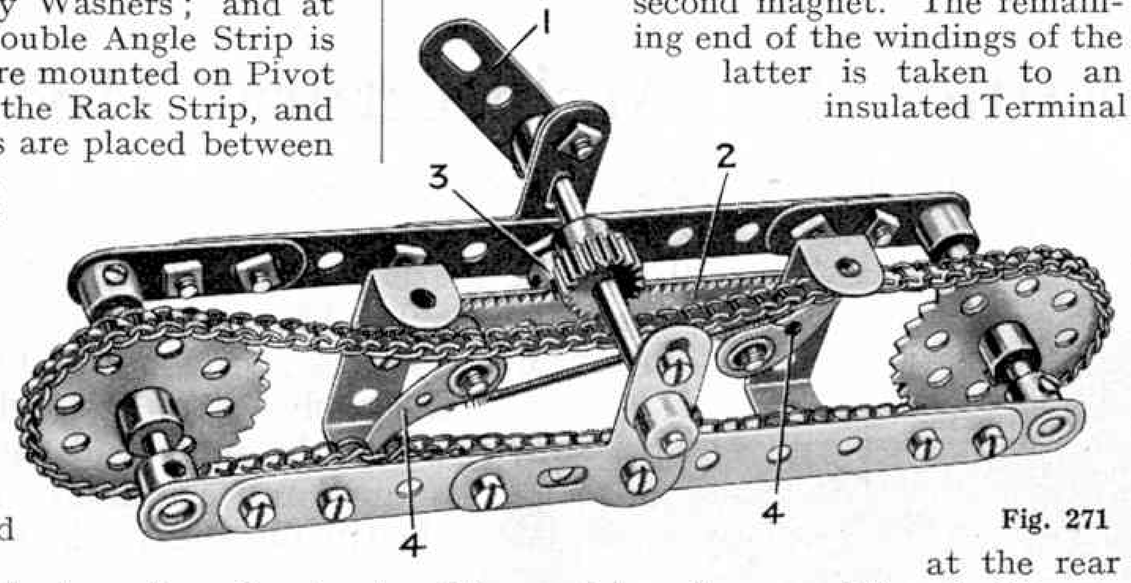


Fig. 271

To operate the device, the Crank 1 is pivotally attached to a connecting link that is pivoted at its other end to a crank, which rocks it to and fro. The movement is transmitted through the Rack and Pinion to the sliding frame, and as this moves to the left the leading Pawl engages the Chain and rotates the Sprocket Wheels. When the movement of the frame is reversed the other Pawl engages the Chain, which continues to move in the same direction, and on the return stroke the first Pawl trails idly over the links.

(272) Magnetic Engine

(G. Hugel, Mulhouse, France)

The novel form of electric engine illustrated in Fig. 272 can be operated successfully from a pocket lamp battery. A pair of electro-magnets form the motive power, and their energy is converted into rotary mechanical motion in an extremely interesting manner. The electro-magnets consist of Bobbins wound with No. 26 gauge cotton-covered Wire, and covered with paper to protect the windings. They are attached to the base plate by means of Pole Pieces, and one end of one magnet winding is attached to an insulated Silver-tipped Contact Screw 2, its other end being attached to one end of the second magnet. The remaining end of the windings of the latter is taken to an insulated Terminal at the rear of the model, and a second Terminal is provided that is in metallic contact with the plate.

The battery is connected to the Terminals at the back of the base Plate, and the current flows along the wire contact 1 to the bolt 2 and eventually to the magnets. These attract the $5\frac{1}{2}''$ Strip, which is drawn downward; and its movement causes the Pawl on its outer end to rotate the Ratchet Wheel 3 through a fraction of a revolution. As soon as the Strip is attracted to the magnets the contacts break apart so that the Strip keeps moving up and down.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

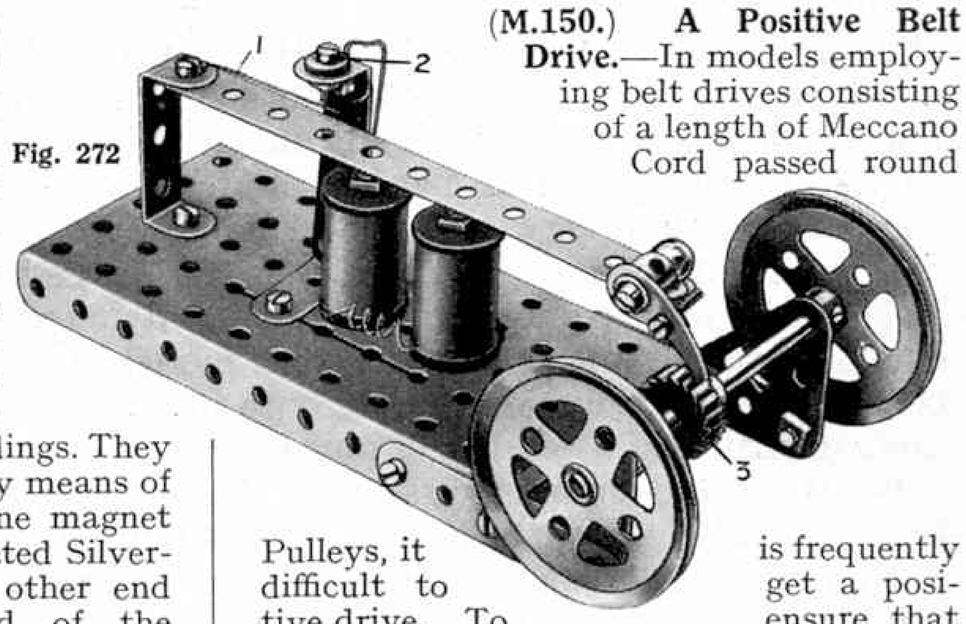
(M.149.) Winder for Aeroplanes.—To wind an elastic-driven aeroplane by hand is a very tedious operation, and there is always a possibility of the hand slipping, often with painful results, as many who have tried this method will know! The time-saving device suggested by D. Brobyn (Norbury, S.W.16), will be a boon to all those who favour the elastic motor for propelling their aircraft.

The essential part of the mechanism is a Clockwork Motor, the driving shaft of which is fitted with a large Fork Piece that engages the aeroplane propeller. The Motor is secured to a stand in such a manner that its height from the ground can be varied, so that it can be used for aeroplanes of different types and sizes. If the models for which it is intended require more power to wind them, a stage of reduction gearing is arranged between the Motor driving shaft and the rod carrying the Fork Piece.

By this means the propeller of the aeroplane can be given approximately the same number of turns for each wind. Thus a full length of run is ensured, and the possibilities of overwinding the elastic are greatly reduced.

(M.150.) A Positive Belt Drive.—In models employing belt drives consisting of a length of Meccano Cord passed round Pulleys, it is frequently difficult to get a positive drive. To ensure that the Pulleys grip the cord, J. Erdington (Manchester) places a small rubber band in the groove of each Pulley, so that the cord rests on the rubber. He claims that this method is more satisfactory than using a rubber band for the belt, as cord transmits a more powerful drive, and does not stretch, or break, like rubber if called upon to withstand a heavy load.

Fig. 272



(M.151.) Differential for Small Models.—J. Whitley (Leeds) suggests a compact differential gear that is very suitable for use in small models, especially when the supply of gears is limited. The device is extremely simple, but not so efficient as a built-up unit using Bevels, or Contrates and Pinions. The rear driving axle is in two pieces, and on the inner end of each Rod is a 1" Pulley Wheel fitted with a $\frac{5}{8}''$ Rubber Ring. The two Pulleys are placed close together so that there is sufficient friction between the two Rubber Rings to make the two halves of the rear axle rotate as one unit.

Only one Rod is driven, so that on taking a corner the tendency for one road wheel to rotate faster than the other overcomes the friction between the Rubber Rings, and the two sections of the back axle rotate independently so avoiding wheel slip.

Grand "Winter" Model-Building Contest

Ninety-Three Fine Prizes to be Won!

THIS month we announce the first big model-building Contest of the winter season. During the past summer months keen constructors will no doubt have had unlimited opportunities of obtaining new ideas for Meccano models, and this Contest offers them a splendid chance to win valuable prizes by putting their ideas into practical shape by means of Meccano.

It is not necessary to have a great deal of experience to successfully compete in this Contest. The simple act of building Meccano models from an Instruction Manual affords all the experience that is necessary to put a constructor well on the road to success. No matter how small or apparently insignificant a model may be it is eligible for entry in this Contest, and we would remind competitors that very often the smallest models prove the most interesting and carry off the largest prizes.

There are no entrance forms to fill in and no fees to pay. The only condition stipulated is that models must be the competitor's own unaided work, both in regard to design and construction. Models of any kind whatever may be submitted, and competitors may please themselves as to the number of parts or size of Outfit used.

In making the awards, the judges will pay special attention to the following points :—

Originality : Special points will be given to those models showing initiative and originality and that are not simply variations of those illustrated in the Manuals of Instructions.

Correct Construction : Models that in their details are constructed on correct mechanical and engineering principles will receive higher marks than those that are built incorrectly or carelessly.

General Interest : Preference will be given to models that are likely to prove most interesting to Meccano users generally.

The actual model must not be sent ; a photograph or a good drawing is all that is required. If these are not very clear, a short explanation of the construction and working of the model should be sent as well as the illustrations.

The Competition will be divided into three Sections : Section A, for readers over 14 living in the British Isles ; Section B, for readers under 14 living in the British Isles ; Section C, for readers of all ages living Overseas.

Closing dates : Sections A and B will close for entries on 31st January, 1933 ; entries for Section C must be posted so as to reach this Office not later than 31st March, 1933. Entries must be addressed to " Winter " Model-building Contest, Meccano Ltd., Binns Road, Liverpool, and should be marked with the appropriate Section letter.

The Prizes

The Prizes to be awarded in Sections A and C are as follows :—

- First Prize : Cheque value £3-3s.-0d.
- Second Prize : Meccano or Hornby goods value £2-2s.-0d.
- Third Prize : Meccano or Hornby goods value £1-1s.-0d.
- Six Prizes of Meccano or Hornby goods value 10/6.
- Six Prizes of Meccano or Hornby goods value 5/–.
- Six Prizes of " Famous Trains " by C. J. Allen.
- Twelve Prizes of Meccano Engineer's Pocket Books.

The Prizes in Section B are as follows :—

- First Prize : Cheque value £2-2s.-0d.
- Second Prize : Meccano or Hornby goods value £1-1s.-0d.
- Third Prize : Meccano or Hornby goods value 10/6.
- Twelve Prizes of Meccano or Hornby goods value 5/–.
- Twelve Prizes of Meccano Engineer's Pocket Books.
- A limited number of Certificates of Merit also will be awarded in each Section.

A New Competition for Architectural Models

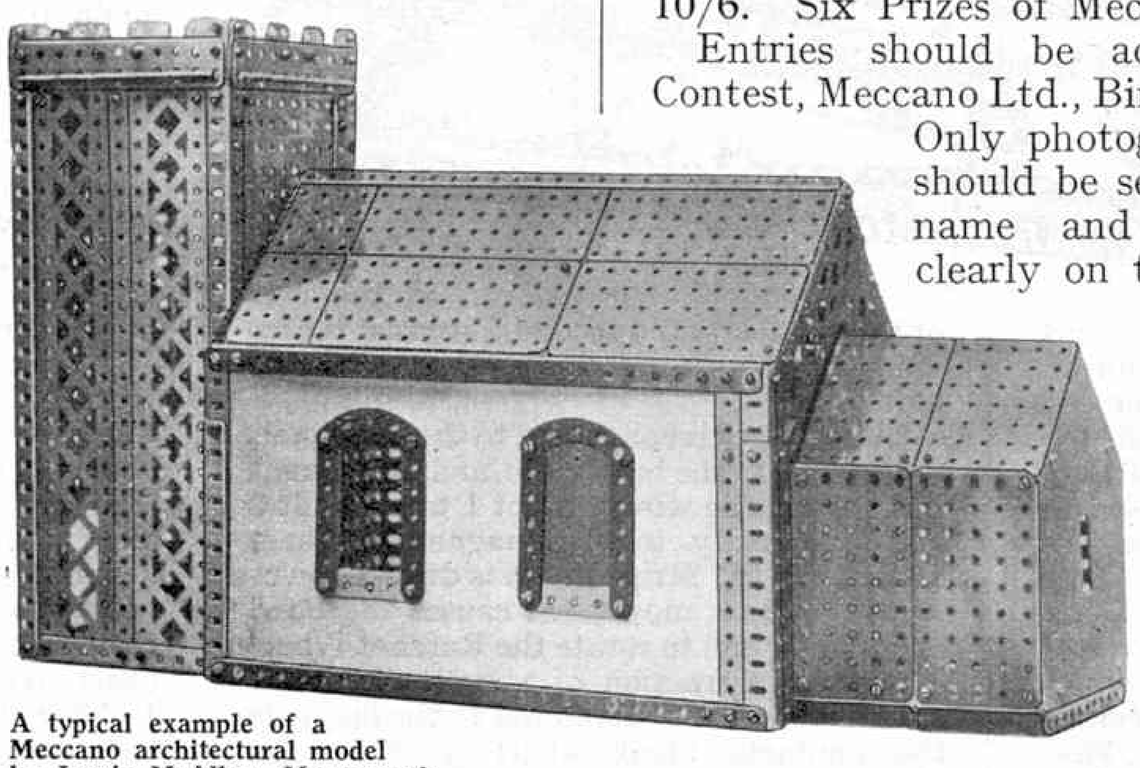
In this competition only models of monuments, cathedrals, churches, houses, or any other architectural subjects built from standard Meccano parts may be entered. A fine example of the kind of models suitable for entry is shown in the church illustrated here, and another good example is the Nelson Column that was illustrated in the October *"M.M."*

There will be two Sections as follows. Section A for competitors living in the British Isles, and Section B for competitors living Overseas. The Prizes in each Section are :—First, Cheque for £2-2s. : Second, Meccano goods selected by the competitor to the value of £1-1s. : Third, Meccano goods value 10/6. Six Prizes of Meccano goods value 5/–.

Entries should be addressed to " Architectural " Contest, Meccano Ltd., Binns Road, Old Swan, Liverpool. Only photographs or drawings of models should be sent, and the competitor's age, name and address must be written clearly on the back of each entry.

Any size of Outfit may be used in building models, and if desired cardboard or sheet metal may be used to fill in wall spaces, as shown in the model church illustrated here.

Section A will close for entries on 31st December, 1932. Overseas competitors must post their entries in time to reach this office by 28th February, 1933.



A typical example of a Meccano architectural model by Lewis McAllen, Moneymusk, Aberdeenshire.

Model-Building Contests Results

By Frank Hornby

"May" Competition (Home Sections)

THE principal awards in the Home Section of the "May" Model-building Competition, which was announced in the May 1932 issue of the "*M.M.*," are as follows :—

Section A (for competitors over 14).

FIRST PRIZE (tie), Two competitors each to receive Meccano or Hornby Train goods value £1-11s.-6d.: K. Wright Cameron, Claughton, Cheshire; L. Hollyoak, Earlsdon, Coventry. SECOND PRIZE (tie), Two competitors each to receive goods value 21/-: B. Whall, Amersham Common, Bucks.; D. L. Medd, Hazelhead, Aberdeen. THIRD PRIZE (tie), Two competitors each to receive goods value 10/6: G. R. Waldron, R. J. Waldron, and H. J. Brown (joint entry), Torquay; G. Riall, Godalming, Surrey.

FIVE PRIZES of Meccano or Hornby goods value 10/6: H. Lockett, Stafford; R. Kearsey, London, E.6; N. Bird, Hull; L. Goodwin, Wembley, Middx.; J. Boileau, Tonbridge, Kent.

FIVE PRIZES of Meccano or Hornby goods value 5/-: L. Wilcock, Sheffield; G. Harper, Berwick-on-Tweed; R. Grant, Aberdeen; G. Barnett, London, N.16; W. Gibbons, London, E.2.

Meccano Engineer's Pocket Books: R. Pearce, Bristol; J. Barham, Rochdale; J. Hooper, Tonbridge, Kent; K. Ison, Cambridge; C. Marston, Halifax; B. Stone, Croydon; B. Wicks, Reading; E. Deakin, Coalville, Leicester; J. Gooch, Twickenham; C. Lomas, Eastbourne.

Section B (for competitors under 14).

FIRST PRIZE, Meccano or Hornby goods value £2-2s.: D. B. Ward, London, S.E.13. SECOND PRIZE, goods value £1-1s.: John L. Good, Stoneycroft, Liverpool. THIRD PRIZE, goods value 10/6: J. B. Nelson, Bootle.

FIVE PRIZES of Meccano or Hornby goods value 5/-: A. Page, London, N.W.6; A. Moreland, Liverpool; W. G. Wright, Oxton, Cheshire; G. Key, Stone, Staffs.; J. Clephane, Edinburgh.

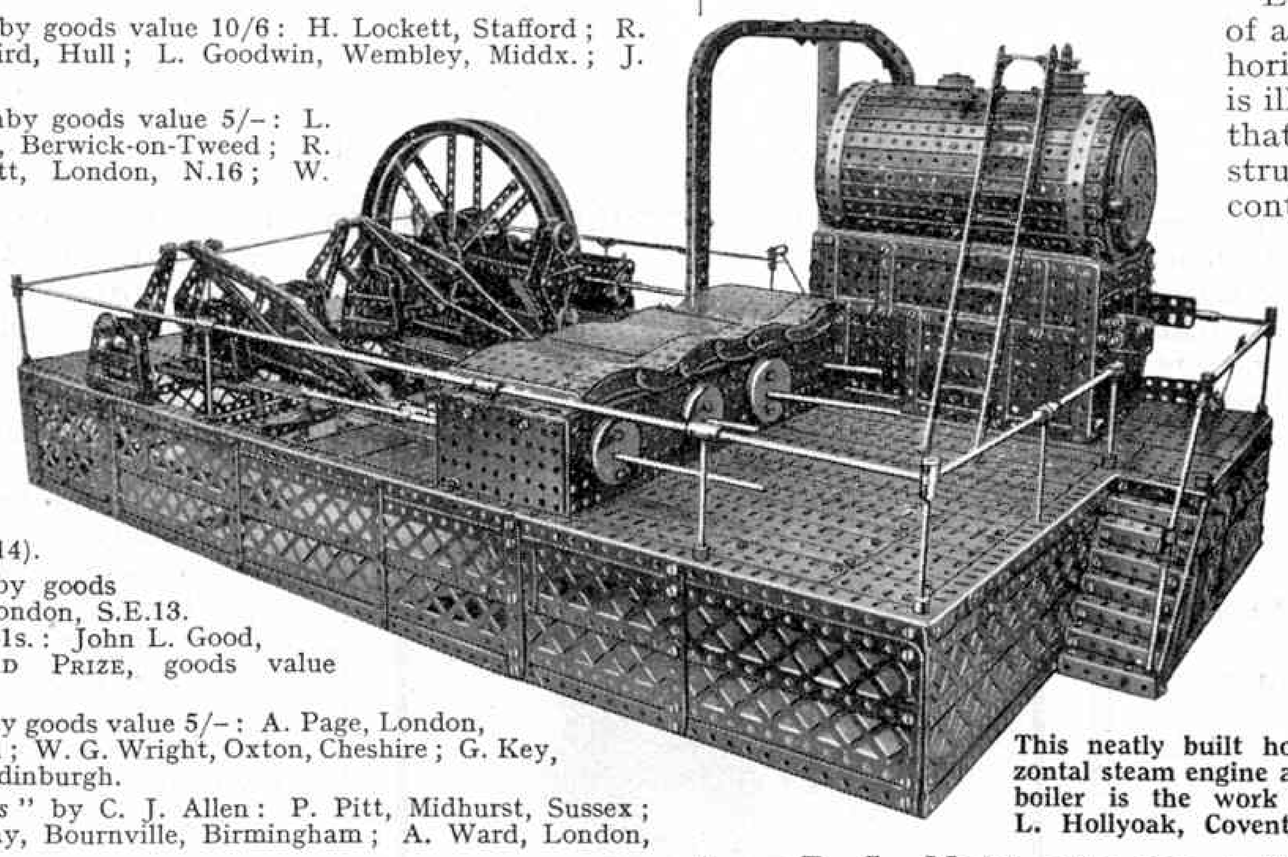
FIVE PRIZES of "*Famous Trains*" by C. J. Allen: P. Pitt, Midhurst, Sussex; L. Tryer, Ilford; J. Hathaway, Bournville, Birmingham; A. Ward, London, E.18; J. Orme, London, N.2.

Meccano Engineer's Pocket Books: G. Davey, Lyndhurst, Hants.; A. Jenkins, Keswick; A. Robinson, Manchester; A. Hinton, Keswick; P. Daniel, Dublin, S.E.6; R. Cooke, Norwich; F. Woodhouse, York; W. Kirk, Sittingbourne, Kent; E. Mansfield, Barnet.

The most interesting model in the Home Section is an automatic electric lift, operated by push-button controls. The model is based on a type of passenger lift frequently installed in public buildings and offices, and was built by K. W. Cameron, Claughton, Cheshire. It will be seen from the illustration here that a great amount of detail is incorporated in the model and this includes "calling" push-buttons on the various floor levels, and "control" push-buttons in the lift cage.

By pressing these buttons the lift can be brought quickly to any desired floor, where it stops until another button is pressed. There is also a special "stop" button in the cage itself, operation of which enables the lift to be brought to a standstill at any position in the shaft.

An ingenious feature is a "dropping floor," which is so arranged that when a passenger steps into the cage his weight causes the cage floor to descend slightly, this action cutting out all the electric circuits connected with the push-buttons on the various floor levels. The passenger is thus left in sole control of the lift until he steps from it at the particular floor at which he wishes to alight. A pleasing feature of the model is that it is built entirely of unmutilated Meccano parts, with the exception of the flexible connections to the push-buttons and dropping floor in the lift cage. To go into detail regarding the construction of the model would require far more space than I am able to allow in this article, and therefore I hope to illustrate and describe this model more fully in a special article that will appear in due course in the "*M.M.*"



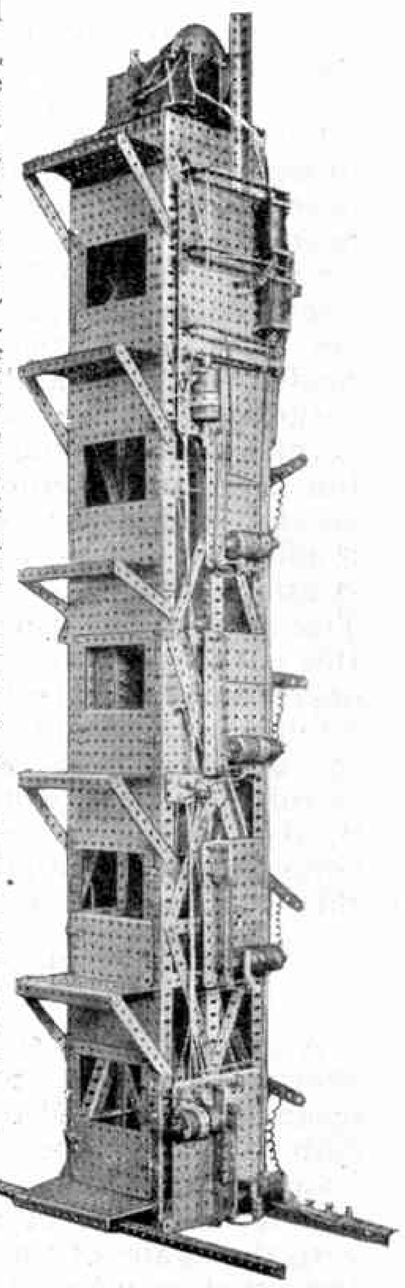
This neatly built horizontal steam engine and boiler is the work of L. Hollyoak, Coventry.

Leslie Hollyoak submitted models of an L.M.S.R. Road-Rail Car, and a horizontal steam engine. The latter is illustrated here, and it will be seen that it is remarkable for its neat construction and good proportions. It contains over 1,380 Nuts and Bolts and has a stroke of 8". Many ingenious and novel uses for Meccano parts are to be found in the model, particularly in the construction of the crosshead guides and the crankshaft.

The Road-Rail Car is an equally well-built effort, and is copied from an actual vehicle of this type that runs between Stratford and Blisworth on the L.M.S.R. system. The model is built in particularly generous proportions, being 40" in length, 11" in width and 14" in overall height.

D. L. Medd, who has built many fine models, some of which have been illustrated in past issues of the "*M.M.*," again won a prize, this time with a unit model of a radial cableway and a Henderson dockyard crane, both of which are beautifully constructed and work splendidly. The crane was built for a trade exhibition at Aberdeen, where it attracted the keen interest of visitors. One of the features of the model is its simple but rigid construction, and it is interesting to note that the model has been used as an advertisement of the actual crane, a fact that testifies the remarkable fidelity with which real engineering structures can be reproduced n Meccano.

D. B. Ward won a prize with a biplane built from a No. 3 Outfit. Ward's success shows that even a simple model, provided that it is well built, has just as much chance of winning a prize as a large complicated structure.



A model of an electric lift that is entirely operated by "push-button" controls at the various floors. Built by K. W. Cameron, Claughton, Cheshire.

May "Lynx-Eye" Contest (Home Section)

The full list of awards in the Home Section of the May "Lynx-Eye" Competition is as follows :—

FIRST PRIZE, Meccano or Hornby goods value £2-2s.: S. E. Smith, Enfield, Middx. SECOND PRIZE (tie) Two competitors each to receive goods value 10/6: W. Crichton, Glasgow, E.1; C. E. Wrayford, Newton Abbot, Devon. THIRD PRIZE (tie), Two competitors each to receive goods value 5/6: N. Rodnight, Bedford; W. Robertson, Edinburgh.

TEN PRIZES of Meccano or Hornby goods value 5/-: E. Tovell, Bungay, Suffolk; E. Scott, Hanley, Stoke-on-Trent; T. Davies, Luton; R. Webb, Beckenham, Kent; R. Hoult, Ben Rhydding, West Yorks.; G. Loader, London, N.7; J. Coleman, Ruislip, Middx.; S. Cutteridge, March, Cambs.; J. Marcham, Evesham, Worcs.; F. Stephens, Bordon, Hants.

Meccano Engineer's Pocket Books: F. Thornton, Scarborough; V. C. Kaile, Mayford, Surrey; C. Hunter, Kings Lynn, Norfolk; C. Hawkins, Ramsgate; F. Truslow, Sutton, Surrey.

June "Errors" Contest (Home Section)

No single competitor in this Contest succeeded in discovering every one of the errors in the Meccano marine engine that was illustrated in page 457 of the June 1932 "*M.M.*," and therefore the prizes were awarded in order of merit to the competitors who found the most mistakes in the model. Under this scheme the prizes were distributed as follows :—

FIRST PRIZE, Meccano or Hornby goods value £2-2s.: H. P. Dicken, Wrexham; SECOND PRIZE, goods value £1-1s.: G. R. Webb, Leatherhead, Surrey. THIRD PRIZE, goods value 10/6: P. Rogers, Blackburn.

FIVE PRIZES of Meccano or Hornby goods value 5/-: G. Taylor, Nottingham; L. Boston, Paddington, London; W. Jones, West Ham; A. Robinson, Chesterfield; E. Williams, Manchester.

A number of Engineer's Pocket Books also have been awarded.

Making the most of Exhibitions

The Christmas and New Year season is a favourite time for Exhibitions, Concerts and displays of models, and preparations for events of this kind are now being made in many Meccano Clubs. Apart from giving members the pleasure of introducing their parents and friends to the scenes of their activities, Exhibitions serve two purposes. In the first place, they are useful means of increasing club funds and resources, for visitors do not grudge the small admission fee usually charged, and most of them respond willingly to the demands of those in charge of side shows, and display great readiness to buy articles made by members and offered for sale at Exhibitions. Secondly, they are a means of gaining new members and of attracting the interest and support of older people who may become good friends to the clubs. Exhibitions that are effective in this manner are more satisfactory than those that merely bring in revenue, but with a reasonable amount of care and forethought both aims may be realised.

An Exhibition is most impressive when it gives proof to visitors that the club organising it enables members to enjoy their hobby in the best of all possible ways, that is, by being thorough and intelligent in its pursuit, for nothing is more distressing than the spectacle of boys idling over their pleasures and making half-hearted use of Meccano Outfits or Hornby Train material. A definite plan of action is essential, therefore, and this must be apparent to visitors if they are to be made to realise that the members of a club are an enthusiastic band working together in harmony and getting a great amount of fun and lasting enjoyment out of their efforts. Older visitors will be quick to note if efficiency and purpose mark the demonstrations of models or displays of Hornby Train operations usually arranged, and if this is the case, those who have time and opportunity may be led to take an active interest in club work. The spirit displayed by members also will influence likely recruits. These will be greatly attracted if they see that members thoroughly enjoy themselves, and it is for members themselves to demonstrate this in a practical manner.

The Information Bureau

A good display should be supplemented by active recruiting efforts, of course, and no Exhibition is really complete unless means are provided of giving information about the Guild or the club to Meccano boys who are not members. In many clubs an "Information Bureau" is organised for this purpose. This is placed in charge of senior members, who are fully conversant with the affairs of the club, and thus are able to answer any questions that may be asked. A stock of Guild leaflets and booklets, and of Meccano literature in general, should be available at the Bureau, and this may be made more attractive by exhibiting the club's Affiliation Certificate, together with photographs taken at previous Exhibitions or on excursions, if these are available.

Meccano Club Leaders

No. 61. Mr. F. L. Bingen

Mr. F. L. Bingen was the founder of the Maestricht (Holland) Meccano Club, and has been its Leader since affiliation was secured in March, 1930. Members of the club are specially interested in the illustration of engineering principles by means of Meccano models, and a feature is made of visits to factories, dockyards, engineering works and structures.

Reports from New Clubs

Last month I pointed out that every member of the Guild who has secured six members has laid the foundation of a Meccano club. The club spirit grows quickly in informal gatherings of Meccano boys brought together in this manner, and I have no doubt that during the next few months many new clubs of this kind will be formed. I shall follow their progress with the greatest interest, and shall always be pleased to do everything I can to assist them to become strong organisations. I hope that secretaries of these clubs, and indeed of all that are not yet affiliated, will send me regular reports in order to enable me to mention them from time to time on the "Club Notes" page, for this will help them to gain recruits and perhaps also to secure a Leader.

While I am dealing with the question of club reports, I should like to add a word to the secretaries of affiliated clubs. I occasionally receive complaints from irate club members that the intervals between the appearance of successive reports of their activities in the Guild pages of the *"M.M."* are too long and at times it is even darkly hinted that certain clubs are specially favoured by the regular inclusion of their reports! The real reason for the comparatively poor showing made by many clubs is to be found in the character of the reports received from them. One purpose of the "Club Notes" page of the Magazine is to encourage the members of clubs by showing them that interest is taken at Headquarters in their activities. A second and very important reason for the inclusion of reports is their value to the club movement generally, however, and uninteresting reports are of little use in the "Club Notes" page. I urge secretaries therefore to send full accounts, both of ordinary meetings and of special events likely to be of interest to other members of the Guild.

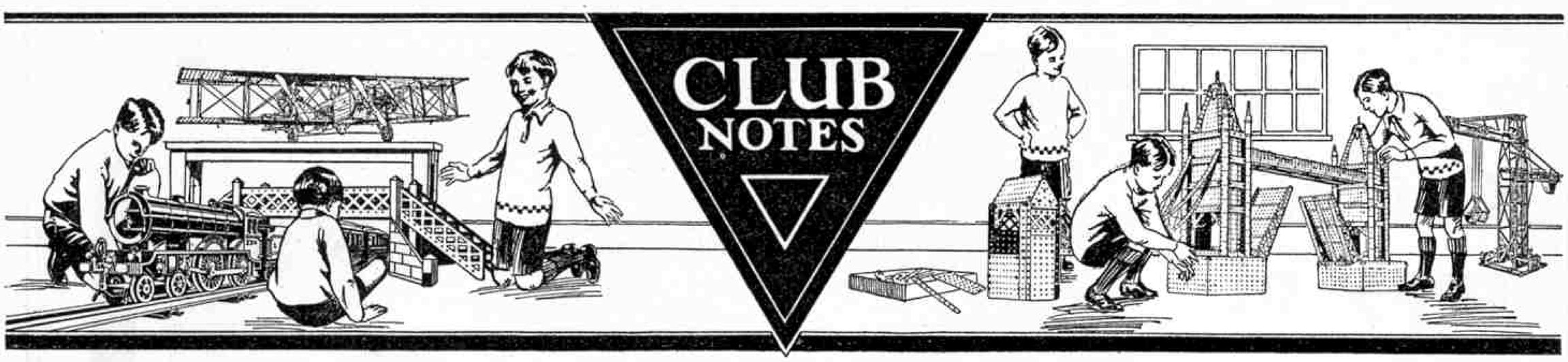
* * * *

The Correspondence Club continues to make satisfactory progress, and as a result of the enrolment of new members more correspondents are required in France, Canada, and South Africa. I shall be pleased to hear from any member of the Guild who lives in one of these countries and would like to exchange letters with a friend of similar interests, and application forms and full details of the Correspondence Club will be forwarded immediately to those who wish to take advantage of the splendid opportunities offered.

Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places and boys interested in becoming members should communicate with the promoters whose names and addresses are given below:—

BELGIUM—Jean P. Kluyskens, 44 rue Quatrelst, Bruxelles.
BRISTOL—R. J. Hodge, 35, Treefield Road, St. Werburghs.
CHESTERFIELD—C. Jolliffe, The Peter Webster School, Whittington Moor.
LONDON—Mr. D. Garnett, 111, Devonshire Road, Forest Hill, S.E.23.



New Bradwell M.C.—Model-building meetings have been held throughout the summer, but attention was mostly directed to outdoor occupations, including rambles, fishing and cricket. One afternoon was spent in hunting for fossils, many of these now being displayed in a glass case; and other excursions have been made to Woburn Sands and Wickstead Park. Club roll: 35. *Secretary:* R. Bellchambers, 29, King Edward Street, New Bradwell, Bletchley.

Twenty-Eight (Edinburgh) M.C.—A special Transport Exhibition has been held, the models displayed including Motor Cars and Lorries, Miniature Railway Stock, Sailing Vessels, Steam Boats, Aeroplanes and Workshops. These were shown in countryside scenery constructed and painted by Mr. B. McCall Barbour, President of the club. Special care is taken by the Leader to vary Model-building Evenings with short talks on current topics of interest, lantern lectures and the formation of a stamp exchange. In addition, Kim's Game, in which Meccano parts are used, is very popular with members, scores being kept in order to continue a competitive interest. Club roll: 16. *Leader:* Mr. Jas. M. Ferguson, 7, Roseneath Terrace, Edinburgh.

Sketty (Swansea) M.C.—The most interesting visit of the outdoor season was paid to the steelworks of Messrs. Baldwins at Gowerton. Members were taken to the works in cars kindly loaned by Mr. T. Malyn and Mr. A. Lawrence, and on arrival they saw the charging and tapping of the furnaces and the rolling of ingots into bars. Other visits have been planned and an attractive programme is being arranged. New members are wanted, and those wishing to join are asked to communicate with Mr. A. Lawrence, 60, Beechwood Road, Uplands. Club roll: 12. *Secretary:* W. M. Thomas, Greenhill Post Office, Swansea.

Clacton and District M.C.—Recent meetings have been very successful and have included a visit to the local Electricity Works, a paper-chase, cycle runs and a very exciting treasure hunt. Several members visited a Camp organised by the Ipswich M.C. at Aldeburgh. These had a splendid holiday under canvas, and the experience gained will lead to an extension of camping activities during next summer. Club roll: 17. *Secretary:* M. H. Carter, 12, Wellesley Road, Clacton-on-Sea.

Macclesfield Central School M.C.—Good progress is being made, membership increasing satisfactorily. A model Dockyard is being constructed for exhibition in the school. This is being equipped with seven cranes of various types, including a Pontoon Crane, and a Warehouse and a Dock Railway also are being provided. The vessels in the Dock include four Liners, four Tugs, and an old-fashioned Paddle Steamer. In addition, two Gunboats are being built for patrol work outside the Dock. Club roll: 28. *Secretary:* V. Walmsley, The Bungalow, Higher Lane, Kerridge, Macclesfield.

East Hull M.C.—A visit of special interest was paid to the works of Shell-Mex and B.P. Ltd. Members saw a newly-arrived tanker being moored and inspected the pumps employed in transferring the oil to the storage tanks, after which they actually entered one of the tanks. The visit ended with an explanation of the analytical tests carried out in the works laboratory. Club roll: 11. *Secretary:* H. Acklam, 103, Newcomen Street, Hull.

St. Columba's M.C.—On the club's Annual Excursion members visited Durham, where the Castle, the Cathedral and Finchale Abbey were the chief attractions. At the Annual Picnic in the garden of Mr. S. Willis, B.Sc., Leader of the club, the Ship Coaler on loan from Headquarters was demonstrated. Summer activities concluded with visits to Boldon Ponds and Sealane. A well-arranged programme is now being followed. Club roll: 10. *Secretary:* D. Ferguson, 3, Edward Burdis Street, Southwick, Sunderland.

Park Modern M.C.—Meetings have been arranged whenever summer activities have allowed. Cycle runs to various places of interest, including Hornchurch Aerodrome, have been arranged, and Baseball, Tennis and other games have been played on the school field. At one meeting Mr. J. Bright, Leader of the club, explained the different types of variable gears for bicycles, and the secretary gave a short talk on "*A Visit to Southampton.*" Club roll: 21. *Secretary:* F. Tingey, 11, Shirley Gardens, New Barking, Essex.

Sid Vale M.C.—Enjoyable rambles, cricket matches and bathing meetings have been held, and a model Fairground was exhibited in a tent on the Bedford Lawn, on the sea front. A model of a Roundabout, a Traction Engine, Swings or some other appropriate Fairground object was contributed by each member. Most of these were working models driven by electric motors, and the display attracted the interested attention of visitors to Sidmouth, the receipts being very satisfactory. Club roll: 18. *Secretary:* R. Gliddon, Sheffield House, Sidmouth.

Stamford Hill M.C.—The Annual Exhibition was a great success. The exhibits included the giant Drag-Line and Meccanograph, constructed as club models, an attractive array of smaller models built by individual members and a Hornby Train Layout. The receipts were satisfactory and the Meccanograph was a valuable source of revenue. Special care was taken to explain the aims of the club to visitors, and as a result 11 new members were enrolled. During the summer the attention of members was divided between cricket and Hornby Train operation on indoor and outdoor tracks. Club roll: 35. *Secretary:* D. Weitzman, 83a, Stamford Hill, London, N.16.

Members of the St. Columba's (Sunderland) M.C. enjoying a rest on the Tunstall Hills after climbing cliffs and playing games. This club was affiliated in November, 1929, and under the efficient Leadership of Mr. S. Willis, B.Sc., has carried out a splendid programme of Model-building, games and hobbies. Special attention is paid to nature study, the keen interest of members in this making summer rambles particularly enjoyable.

AUSTRALIA

Ravensthorpe M.C.—A very successful Concert, followed by a supper, realised the sum of £7/3/6. The Concert programme included a play, monologues, readings and songs, followed by a gymnastic display. At other meetings debates are held and games played as additions to Model-building activities. A Miniature Rifle Range is being constructed, and arrangements are to be made for a Christmas camp on the coast. Club roll: 14. *Secretary:* L. E. Daw, Ravensthorpe, Western Australia.

Sydney M.C.—Two Super models have been constructed. These are a 4-6-4 T Locomotive and a Motor Chassis, the Meccano Steam Engine being employed to drive the second of these models. In a "Simplicity" Contest the chief prize was carried off by a model Traction Engine. A lecture on "*Gears*" was given by one of the members, and a visit was paid to the Technological Museum. Model-building and other preparations for the club's Exhibition also have been industriously carried on. Club roll: 28. *Secretary:* W. J. T. Watson, 595, Parramatta Road, Leichhardt, N.S.W.

Woodville M.C.—The chief models constructed have been Workshops, driven by Steam Engines, and Racing Cars. A visit has been paid to the Adelaide Glass Bottle Works, where the intricate bottle-making machinery was closely inspected. Special efforts are being made to widen the scope of club work and thus to enable more members to be admitted. Club roll: 15. *Secretary:* D. B. Robert, 21, The Grove, Woodville, South Australia.

NEW ZEALAND

Murihiku M.C.—Successive meetings in a splendidly varied programme have been devoted to Stamps and Photography, Hornby Trains, an Exhibition of models, games, and a lecture on "*Electrical Power,*" kindly given by a local electrical engineer. The models on view at the Exhibition included Motor Boats, Aeroplanes and Racing Cars, and other hobbies represented in the display included painting on glass, and the construction of working models and toys of all kinds. Roomier club premises are now necessary in order to avoid overcrowding, and Junior and Senior Sections have been formed. Club roll: 40. *Secretary:* S. Wilson, North Road, Waikiwi, Invercargill.

Sumner (Christchurch) M.C.—Enjoyable Model-building Competitions have been held, including one in which entrants were required to build a model from given parts in a definite time. In a Racing Car Contest competitors showed great skill in streamlining their entries, and in a "Simplicity" Contest ingenious representations of the Bennie Railplane, a Pile-Driver, Naval Gun, Swing Bridge and Porter's Barrow were on view. Club roll: 15. *Secretary:* I. C. Booth, 41, Head Street, Sumner, Christchurch.

SOUTH AFRICA

Malvern M.C.—Members have been very successful in the £500 Model-building Contest, five prizes having been secured. Club work is enthusiastically maintained, outdoor meetings having included cricket matches, picnics and cross-country runs. Model-building Contests have been held in addition to games meetings, debates and ordinary Model-building Evenings, the models constructed by members including a See-Saw, Fire Engine, Breakdown Crane and a representation of the Head Gear of a Gold Mine. A specially interesting evening was devoted to a "What and Why" Contest, members asking each other a series of difficult questions, many of which were very amusing. A Union of clubs in Johannesburg and district is being formed. *Leader:* Mr. E. Sykes, P.O. Box 8, Cleveland, South Africa.

Turffontein M.C.—A remarkable number of interesting visits to works and other places of interest has been the chief feature of the programme. The works visited have included a paint factory, one in which wire netting is woven, and an iron and steel works, where the making of a complete tube mill for one of the gold mines of the Rand was seen. Members also cycled to the Rand Airport at Germiston, the Swartkopjes Pumping Station and the local Broadcasting Station. Indoor meetings have been devoted to Model-building, Readings from the "*M.M.*" and stamp discussions, and Talks have been given by Mr. J. J. Pienaar, Leader of the club, on "*Building Model Locomotives and Trucks,*" and "*Making an Electric Motor.*" Club roll: 12. *Secretary:* K. Tanner, 146, Ferreira St., Kenilworth, Johannesburg.

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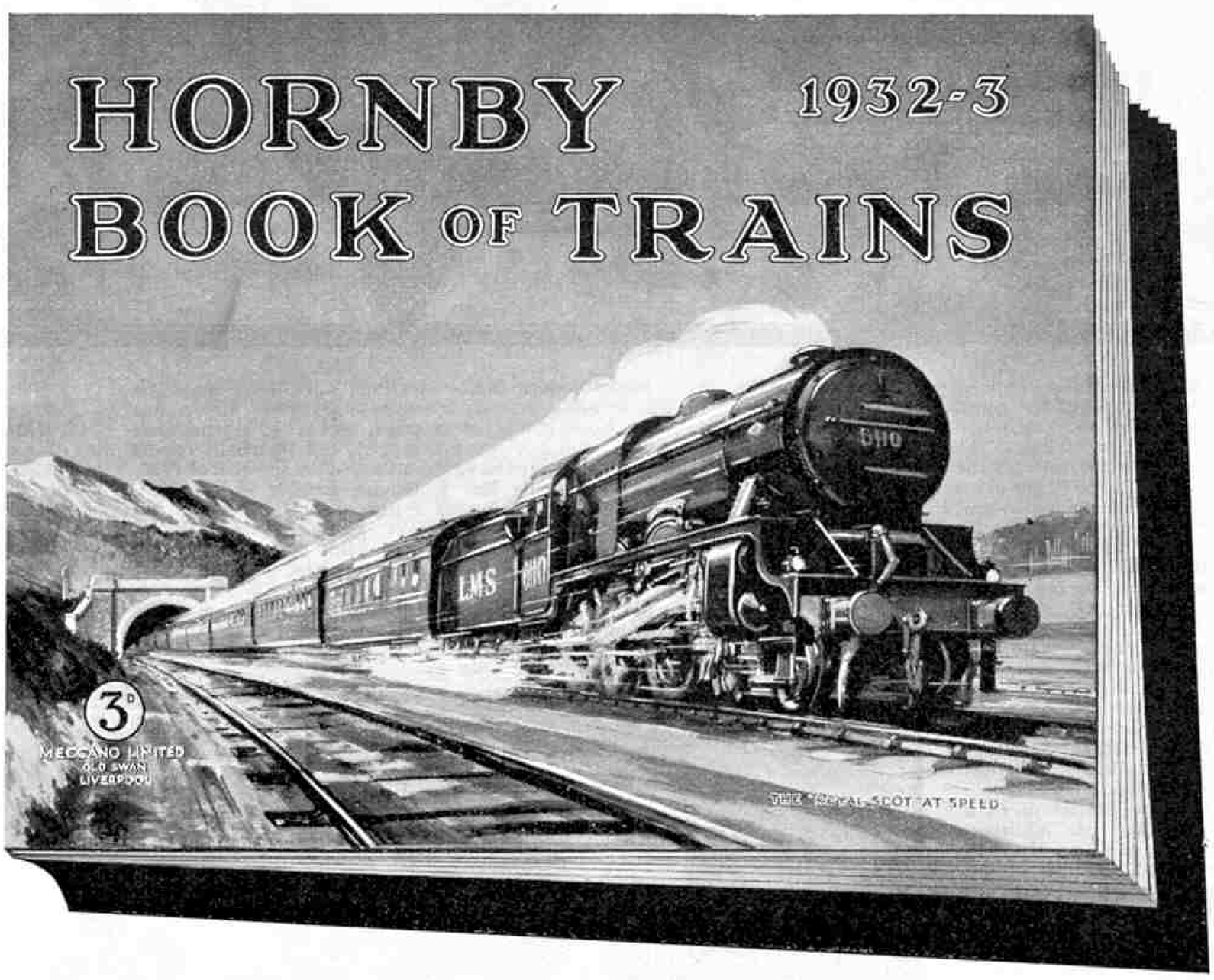

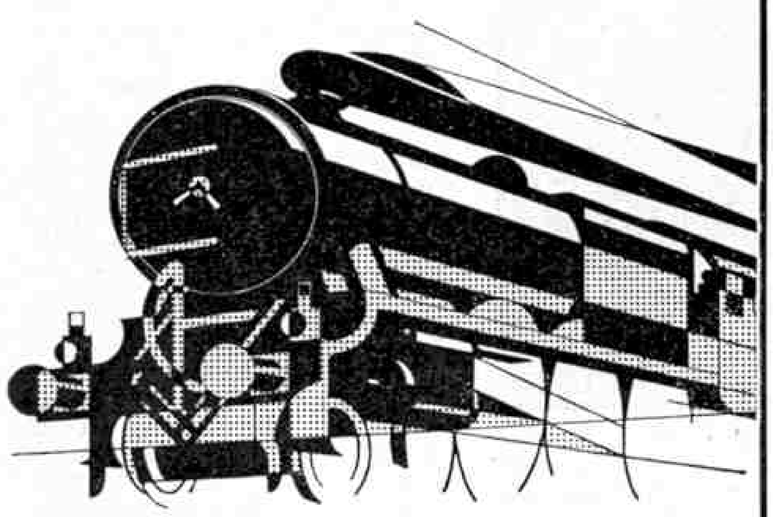

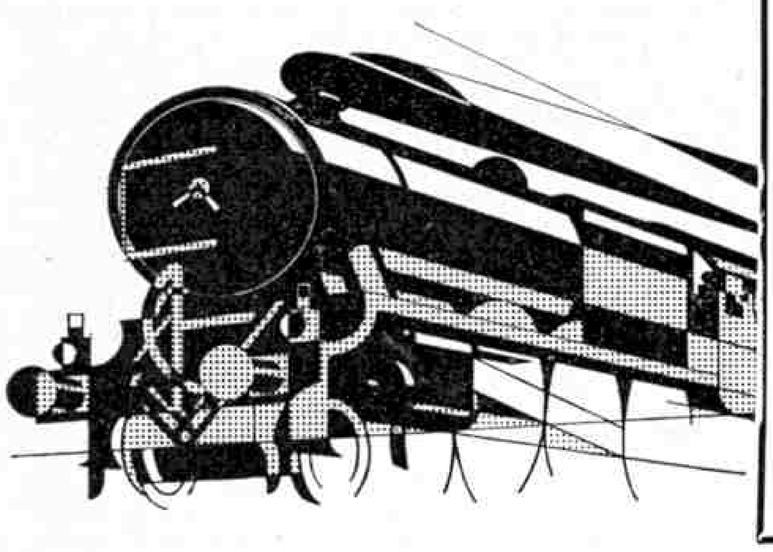

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Overseas Agencies:

NEW ZEALAND: Models Limited, P.O. Box 129, Auckland (Third Floor Paykel's Building, Anzac Avenue).

SOUTH AFRICA: Arthur E. Harris, 142, Market Street, Johannesburg (P.O. Box 1199).

CANADA: Meccano Ltd., 34, St. Patrick Street, Toronto.

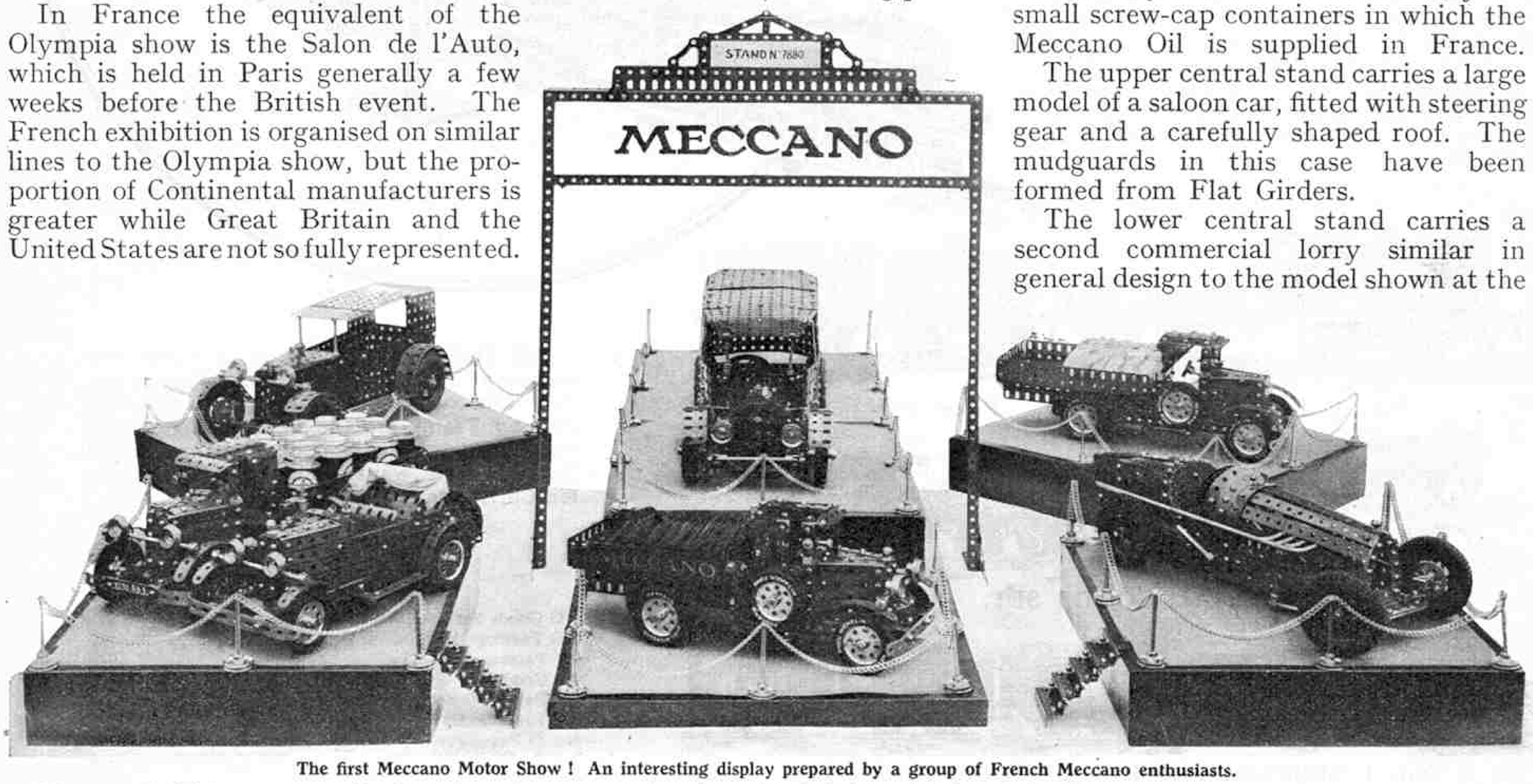
MECCANO LTD. (Dept. A.M.) OLD SWAN LIVERPOOL

An All-Meccano Motor Show

Miniature Cars in Realistic Setting

AN event of outstanding importance in the British motoring world is the Motor Show that is held during the Autumn at Olympia, London. At this exhibition all that is new in motoring is on view, and thousands of enthusiasts flock to Olympia to inspect the new machines and accessories. The Motor Show may be considered an accurate mirror of the world's motor manufacturing activities, Great Britain, France, Italy, Germany, Austria and the United States being represented.

In France the equivalent of the Olympia show is the Salon de l'Auto, which is held in Paris generally a few weeks before the British event. The French exhibition is organised on similar lines to the Olympia show, but the proportion of Continental manufacturers is greater while Great Britain and the United States are not so fully represented.



The first Meccano Motor Show ! An interesting display prepared by a group of French Meccano enthusiasts.

Motor exhibitions naturally have a great attraction for model-builders who specialise in the construction of motor vehicles in Meccano, but in spite of this the idea of an exhibition devoted entirely to cars built from Meccano does not seem to have occurred to constructors. Recently, however, some French enthusiasts decided to arrange a Meccano Motor Exhibition, and the result of their efforts is shown in the interesting photograph reproduced on this page. These model-builders, therefore, may claim the honour of organising the first Meccano Motor Show !

The upper platform at the left-hand side of the display carries a neat model of a four-seater saloon car. This model uses 2" Pulleys and Tyres for the road wheels. The lower stand at the left carries two models, a commercial lorry or "light truck," and a two-seater car. The lorry is carefully proportioned, and it resembles the type of light truck that is used extensively by farmers and general contractors. The mudguards of the model have been represented by Strips bent so as to fit round the wheels. The head lamps, each consisting of a $1\frac{1}{8}$" Flanged Wheel, are mounted on an Axle Rod that is secured between the mudguards in the following manner. A Collar is secured on each end of the Rod, and a Bolt is passed through one perforation in the mudguard into the tapped bore of the Collar. Two Washers are placed on the shank of the Bolt so that the Collar is locked rigidly to the Strip forming the mudguard. This results in a particularly neat mounting for the head lamps. Notice should be taken also of the front bumper (a Meccano Strip) complete with number plate ! The realism of this model has been increased considerably by placing a number of "oil drums" on the loading platform of the lorry. The drums are actually the small screw-cap containers in which the Meccano Oil is supplied in France.

The upper central stand carries a large model of a saloon car, fitted with steering gear and a carefully shaped roof. The mudguards in this case have been formed from Flat Girders.

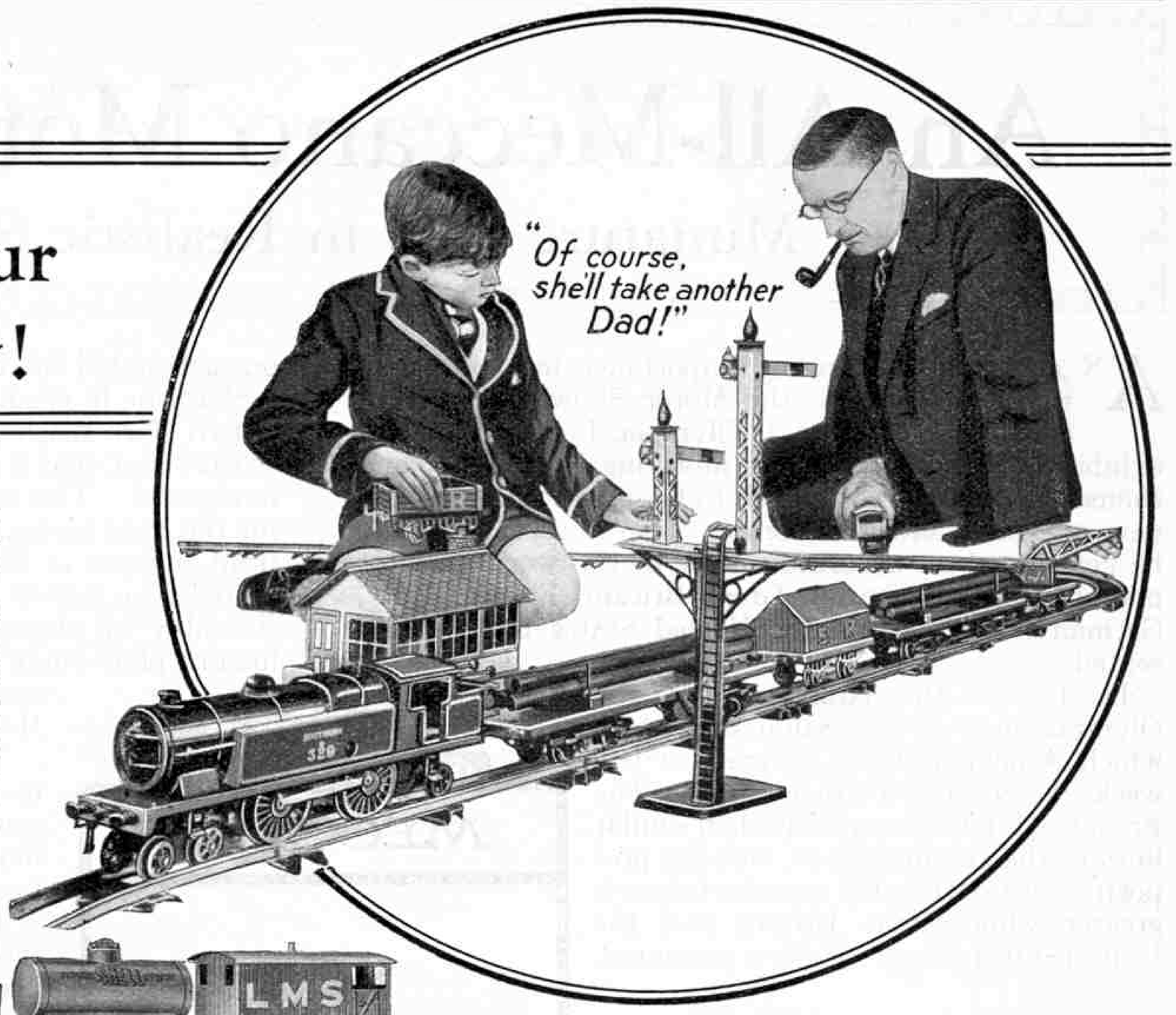
The lower central stand carries a second commercial lorry similar in general design to the model shown at the left-hand side of the illustration, but in this case the load consists of a consignment of Meccano Tyres. The lorry placed on the top right-hand stand carries a number of Meccano Sacks, part No. 122.

To complete this interesting collection of Meccano vehicles a clever model of a French road racing car is shown on the lower right-hand stand. This is a model of the latest Delage eight-cylinder racer, and the model has many of the characteristic external features of this famous car. Particular note should be made of the four manifold exhaust and the external brake lever.

Finally a word must be said for the realistic manner in which the stands themselves have been arranged. The standards placed round the platform are composed of Axle Rods mounted in 1" Pulley Wheels, and Sprocket Chain is hung between the Rods. The steps up to the platforms are composed of a number of short Angle Girders bolted together.

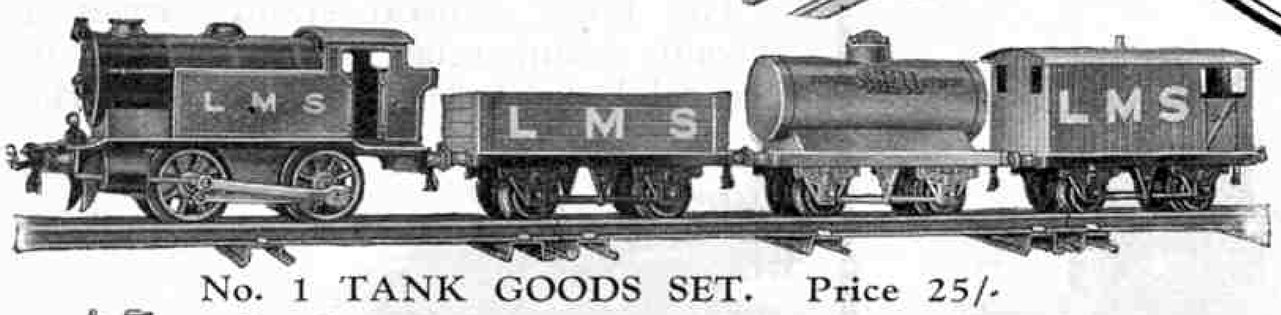
We feel sure that all Meccano boys will be interested in this novel Meccano display, and we look forward to receiving details from British constructors who have arranged a display of Meccano cars of "All-British" types.

Boys, Run Your Own Railway!



Hornby clockwork and electric trains are the best that you can buy. The Locomotives are built for heavy loads and long runs; the Rolling Stock is strong, smooth running and durable; the Accessories are realistic and correct in proportion. Every article is made of the finest material, by British craftsmen.

It will be a great moment in your life when you have a Hornby Train Set, and are able to play the great game of railways. Nothing could give you greater pleasure, there is no other game you'd be as keen to play.



No. 1 TANK GOODS SET. Price 25/-

No. 1 SPECIAL GOODS SET. Price 32/6

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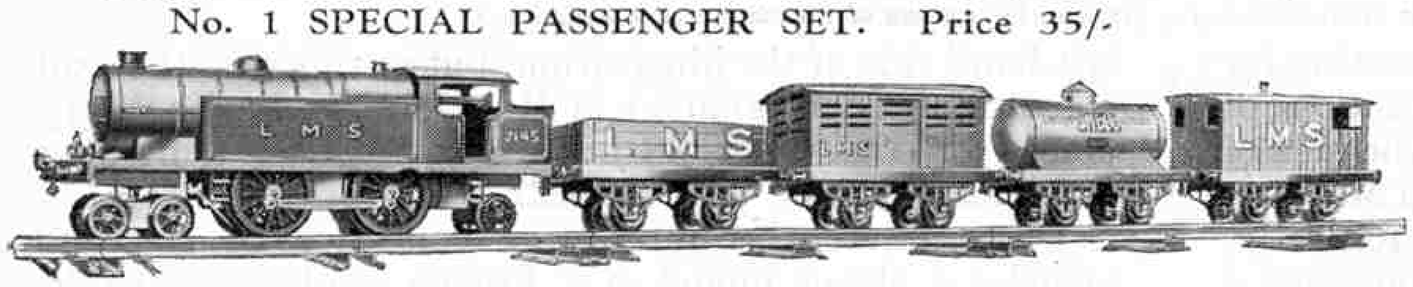

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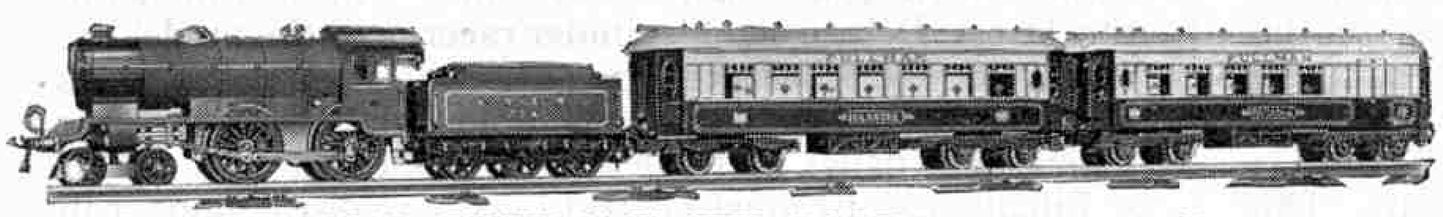

No. 2 SPECIAL PULLMAN SET, L.N.E.R. Price 67/6

Tell Dad what you think of these fine models of modern engines and rolling stock. Tell him what every boy knows—that Hornby Trains are the best, strongest and most efficient model trains in the world! Tell him you want a Hornby Train Set for Christmas!

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MO Passenger Set	5/9
M1 Passenger Set	9/3
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No. E3 Set Riviera "Blue"	80/-
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HORNBY TRAINS

BRITISH AND GUARANTEED

MANUFACTURED BY MECCANO LIMITED OLD SWAN LIVERPOOL

Branch Notes

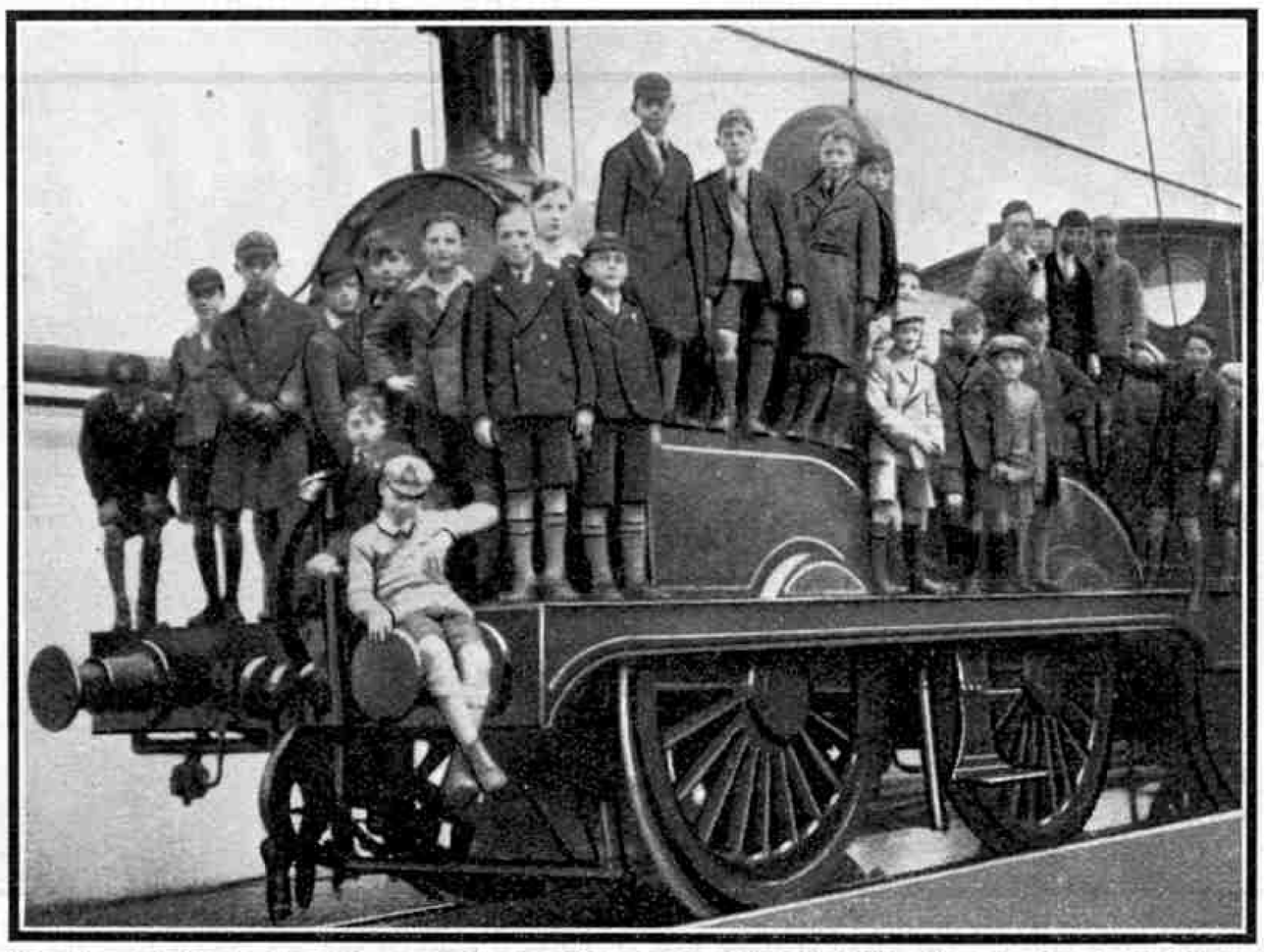
NOTTINGHAM HIGH SCHOOL.—On the chief visit of the outdoor season members inspected the L.M.S.R. Works at Derby, non-members who attend the school being invited to take part. A thorough inspection of every shop was made, and after examining models of the "*Rocket*," and other early locomotives, the visitors spent a period on the footplate of "*Fury*," the L.M.S.R. high-pressure compound locomotive, the boiler system being fully explained to them. A series of lantern lectures have been given and other meetings have been devoted to track running, the layout having been extended and improved by the addition of an electrified branch line. Secretary: F. Nabarro, 4, Grosvenor Avenue, Mapperley Park, Nottingham.

CATERHAM SCHOOL.—Lectures have been given on "*Canadian Railways*," "*The Great Western Railway*," and the G.W.R. locomotive "*King George V.*" Modern methods of signalling also have been carefully studied and summer visits have included what is described as an "Expedition." Members inspected the G.W.R. Locomotive Sheds at Old Oak Common, where they were given a ride on 4–6–0 No. 4052, "*Princess Beatrice*," one of the "Star" class; and then visited the Post Office Railway Station at Mount Pleasant, where they were allowed to pull over the levers by means of which the little trains are started on their journeys on which no driver is needed. Secretary: D. E. Paterson, Caterham School, Caterham.

PORTSMOUTH NORTH END.—Interesting additions to the layout include a hump-shunting yard and a large wharf on the banks of an imitation canal. A siding leading to the wharf has been laid down to enable coal to be shipped. Scenic accessories now include a complete farmyard, and the track has been bridged in order to allow the passage of a stream flowing through the yard. The finished track was shown at the Branch Exhibition, when timetable working was carried out with great success, the result of diligent rehearsal on the part of members. More than 130 visitors were present, the number being a satisfactory increase on that of last year. Secretary: C. Mortby, 35, Beresford Road, North End, Portsmouth.

ELMSIDE (EXETER).—The increase in traffic gave rise to much congestion on the Branch track, and after careful consideration at a Directors' meeting, the Manager was instructed to lay out a double track. This has now been completed and the overcrowding problem solved. The principal train is the "*Cornish Riviera Express*," from which two coaches are slipped when travelling at full speed. Patent wheel stops invented by a member have been introduced, and a 2–6–4 Tank Locomotive, "*Starcross*," constructed and presented by Mr. R. Rush of Accrington, has been brought into service. Mr. Rush is a regular correspondent of the club and visited Exeter during the Summer holidays. Members are now directing their attention to extensive improvements and additions to rolling stock. Secretary: J. Blaker, c/o 60, Elmside, Exeter.

HEATH MOUNT.—The track has been re-planned in order to represent the route taken by boat trains from Manchester, Sheffield and Lincoln to Harwich. A signalling system is being installed, and a timetable for the running of boat expresses has been worked out. These expresses are fitted with home-made destination boards, and each member is responsible for one section of the route. Members make excellent use of large railway maps hung on the walls of the Branch room. Secretary: J. S. Battersby, Kingswood, Manchester Road, Fairfield, Manchester.



Members of the Southampton Branch, No. 230, on an 0-4-2 "Jubilee" of the former L.S.W.R. during a visit to the Eastleigh Locomotive Works of the S.R. This Branch was incorporated in May of last year and has made splendid progress under the guidance of Mr. G. C. Pope, Chairman, and Mr. P. Atkinson, secretary of the Branch.

AUSTRALIA

MELBOURNE.—A keen debate was held between members and those of the associated Meccano Club on "*Motors v. Railways*." A second joint meeting with the Melbourne M.C. was devoted to the construction of Meccano models and their employment in a specially designed Hornby Train layout. The models included a Gantry Crane, Signals, a Footbridge and an Automatic Signal operated electrically by the wheels of an approaching train. Mr. R. Pearson, Chairman, gave a lantern lecture on "*A Trip Across Canada on the C.P.R.*" Visits were paid to the P. & O. liner "*Orama*" and to Spencer Street Station, where the "*Sydney Limited*" was seen. Secretary: L. Ison, 8, Hayes Street, Northcote, N.16, Victoria.

WESTRALIAN.—An outstanding recent event was the Model Railway Display arranged in a shop window by members during "*Railway Week*." Regular demonstrations were given and the working of the layout was explained to the assembled crowds by means of a microphone. The display aroused extraordinary interest, particularly among railwaymen, and it was highly commended by the Commissioner of Railways in the Western Australian Government, who paid a special visit to the display, and in articles published in the local press. Secretary: S. H. Chittenden, 31, Venn Street, N. Perth, Western Australia.

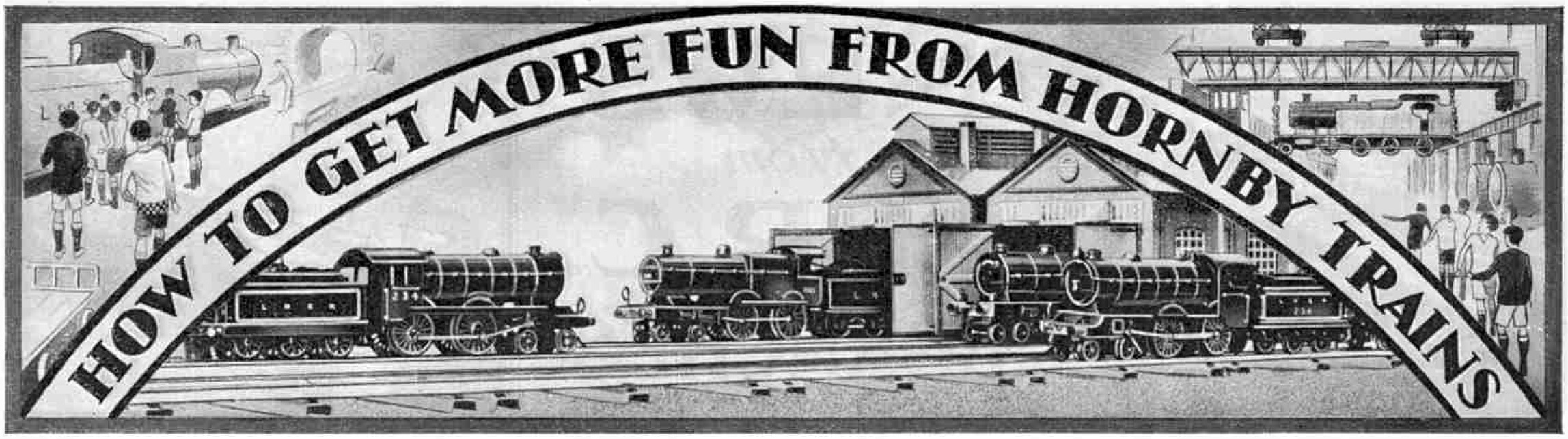
Proposed H.R.C. Branches

The following new Branches of the Hornby Railway Company are now being formed, and boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby Trains or accessories are eligible for membership, and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

LONDON—Guy Kent-Broadwater, 9, Glenshiel Road, Eltham, S.E.9.

LONDON—Mr. J. W. Stubbs, 35, Woodlands Avenue, Finchley, N.3.

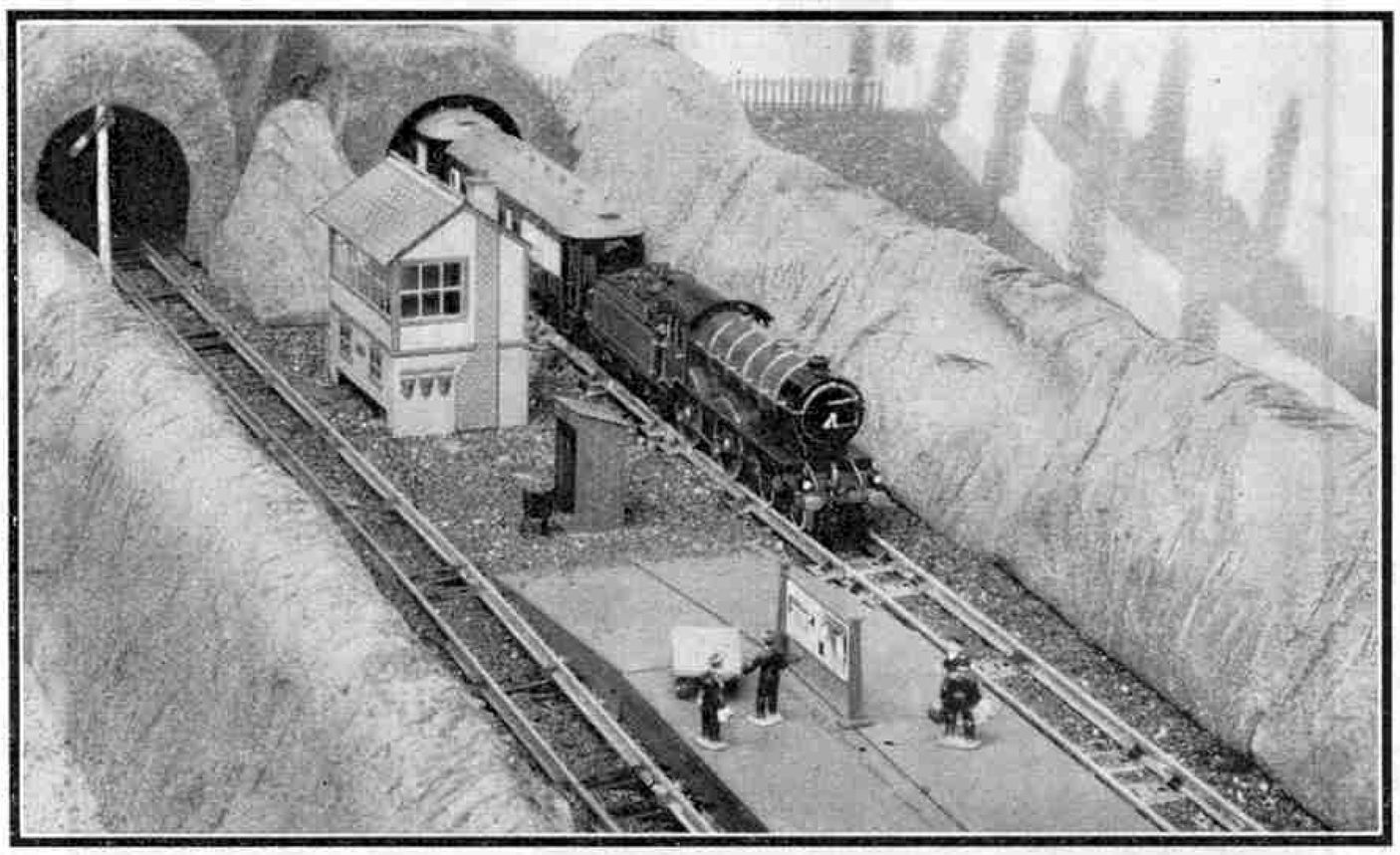
SOUTH AFRICA—G. Kuys, "Beldale," 1059 Schoeman Street, Transvaal.



XLIX.—IMPROVING THE APPEARANCE OF A LAYOUT

BY this time of the year the miniature railway hobby is again well started and the various schemes for improvement that every keen railway owner decides upon from time to time are in full swing. Apart from the question of track layout, which is always capable of modification, there is the question of the various improvements that can be made in the effect of the system as a whole, and which raise it from the plane of a bare collection of tracks, stations, and sidings, to a model railway in the best sense.

Those who are lucky enough to possess permanent layouts have a considerable advantage over those who are only able to use their railways at certain times, and have to remove them when finished with. Recent improvements and additions to the Hornby Series are reducing this advantage, however, as will be realised when we remember such useful and effective items as the new Tunnels, Cuttings, Fencing and Trees. It is in such scenic subjects that the advantages of the permanent layout are usually shown, but as now made, these items are equally suitable for permanent or intermittent use.



An effective station layout in which good use is made of Hornby Tunnels, Cuttings and other accessories mentioned in this article. The island platform type of station is compact and is a change from the usual arrangement where two separate platforms are used, one for each track.

Let us consider first the cuttings and their approaches. Formerly the only way to obtain such effects was to rig up a rough wooden framework in the required position and spread crumpled brown paper or other material over this, tacking it down where necessary, and finally colouring it with paint, dabs here and there representing tufts of grass, rock, or other features as required. While this scheme was satisfactory to a certain extent on permanent layouts, it was difficult to apply to lines of a portable nature, as unless the cutting was made up on a base it could not be moved successfully.

The Hornby Cuttings, however, are as easy to apply to temporary tracks as to those of a permanent nature. As described recently by "Tommy Dodd," the Cuttings are made in sections as separate units, so that as many Cutting No. 2 pieces may be placed end to end as required, the sloping approaches being effected by the use of the special end pieces known as Cutting No. 1. The latter may also be applied to lead up to the various Tunnels, and very fine effects are to be obtained in this manner, as is shown in the photograph on this page. Here an island platform station is situated in a cutting, and as the up and the down tracks are necessarily wide apart, two Tunnels are used alongside one another. The cutting banks, made up of a number of Cutting No. 2 pieces, run up to the Tunnel mouths, and additional effect is given by the use of the sloping end piece, Cutting No. 1, in between the two bores to lead up to the Tunnel face. Difficulties with regard to the negotiation of curves are overcome by the special Cutting No. 3, a succession of which pieces, laid end to end, make an effective cutting bank for 2 ft. radius curves.

Another question of importance is that of providing satisfactory trees in the surroundings of the line, apart from any that might be introduced in painted background scenery. The Hornby Trees are supplied with ingenious clips that enable them to be mounted either on the Paled Fencing with which they are supplied, or on the railings of stations. Some very effective settings can be arranged in this manner for stations, reminding us of the pleasing natural layout of many actual stations with which we are familiar.

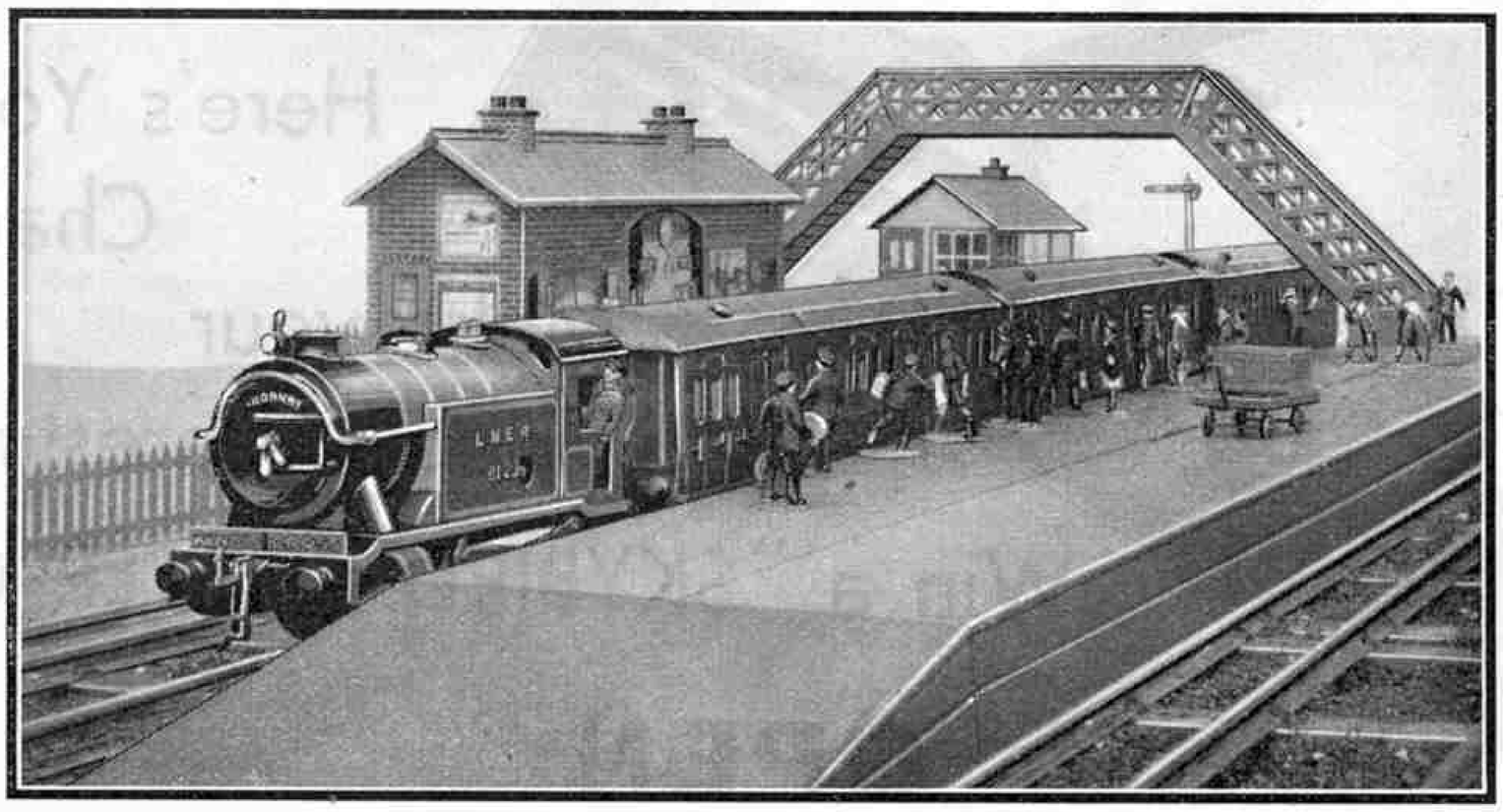
An interesting introduction that opens up considerable possibilities is Modelled Miniatures No. 2, consisting of farmyard animals. These animals are realistic in appearance, and are very effective for lineside use. They are also splendidly adapted for a miniature railway in which the carriage of livestock is to be made a prominent feature. An effective cattle pen can be made up from the Passenger Platforms and Paled Fencing already available in the Hornby Series, and this subject was dealt with fully on the "In Reply" page of the "*M.M.*" for August last. The lower illustration on

this page shows the effective appearance of a miniature pen made up in this manner, with animals waiting in it ready to be loaded away in Hornby Cattle Trucks. Where heavy loadings are to be handled, the greater capacity of the bogie Hornby No. 2 Cattle Truck gives it a distinct advantage over the four-wheeled No. 1 Cattle Truck. Special stock trains made up of these vehicles may be run when required in connection with markets or agricultural shows, and they will add realistic variety to the trains in regular operation.

The miniature passengers now available were mentioned in detail by "Tommy Dodd" last month, and the upper illustration on this page, showing some of them on a station platform, will be of interest. The use of these figures is essential if a station is to be given a really "live" appearance. The train in this photograph is interesting, and is typical of most suburban stopping trains. It is made up of Hornby Metropolitan Coaches, which are made to do duty as L.N.E.R. vehicles, a No. 1 Special Tank in that company's livery being at the head of the train. A typical feature is the destination board carried on the front of the engine. The use of these boards was very common at one time on suburban trains, but they are not seen so frequently nowadays.

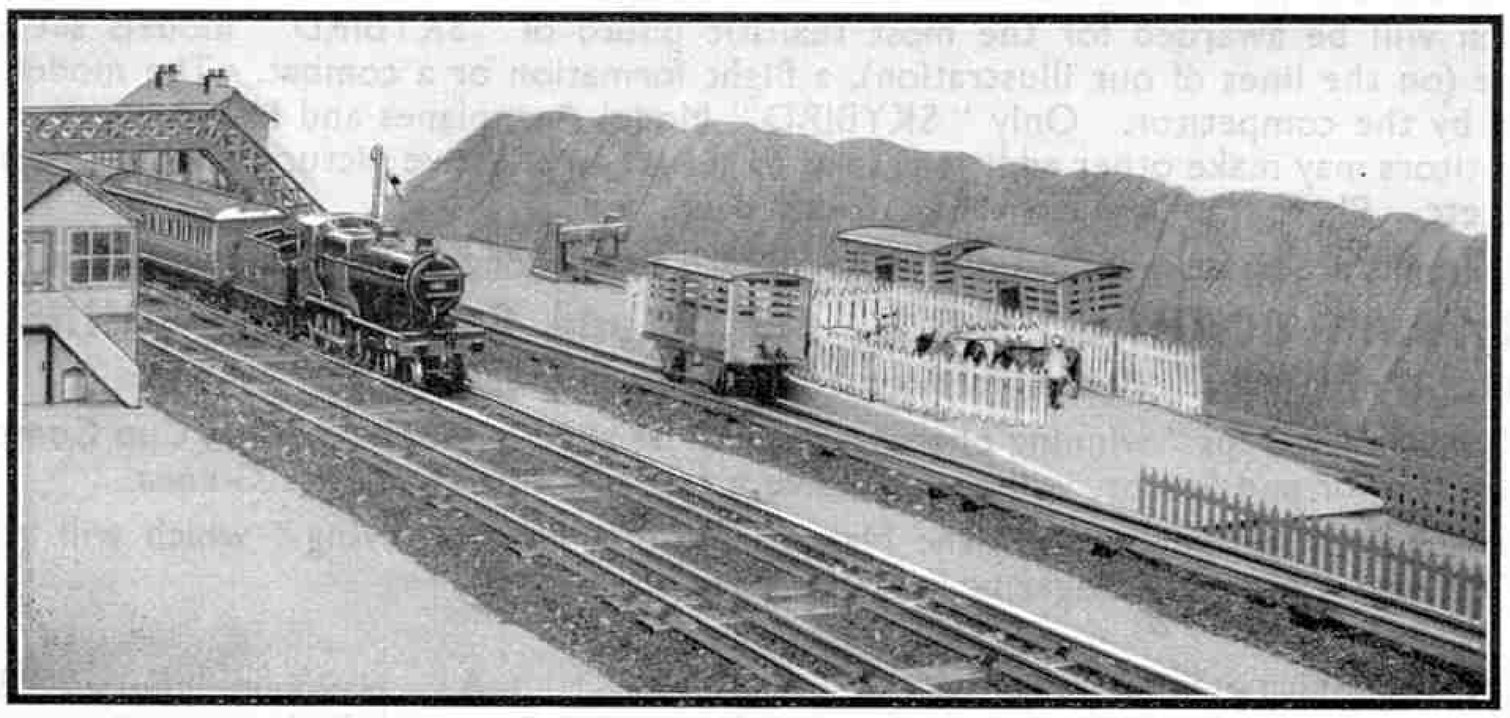
The board in the photograph will no doubt be recognised by Hornby Railway owners as having been cut from one of the Train Name Boards, on which the name "King's Cross" appears. It is fitted to the engine by placing the centre of the board behind the middle lamp bracket, so that its ends are sprung against the brackets over the buffers. It is thus held in position satisfactorily, but may easily be removed when required. A stock of such boards having actual or imaginary destinations may well be made up by Hornby Railway owners, white card being a satisfactory material for the purpose. The employment of the lamp brackets in this novel manner takes advantage of the fact that the indication for a stopping train is given by a single lamp on the upper bracket, so that the lower ones are free.

In considering methods of improving a layout the older and more familiar accessories of the Hornby Series should not be overlooked. Each station should have its Signal Cabin, Telegraph Poles should border the line, Signals should be placed where necessary, and Water Towers should be situated in convenient places. Platelayer's Huts have numerous uses in addition to their designed purpose, such as for coal offices, and staff buildings generally, in a miniature railway yard. November is proverbially associated with fog, so that this month the use of the Watchman's Hut is particularly appropriate!



A suburban train standing at a station where the use of miniature figures is effective. The destination board on the locomotive is of interest and is easily held in position by the lamp brackets.

Among the smaller accessories are the Luggage, Milk Cans, and general platform gear of the sets of Railway Accessories, and the Station Hoardings and Posters. Trains may have their correct names or destinations indicated by means of the Train Name-boards, and an interesting point in connection with the Clips for attaching these boards is that those contained in the No. 2 Set, and intended for No. 2 Pullman and Saloon Coaches, may be attached quite successfully to Metropolitan Coaches. No doubt many Hornby railway owners will have found this out for themselves, but those who have not yet done so may be glad of the information. This allows the coaches to be used for important services, and to carry the appropriate roof boards.



A stopping train leaving a wayside station. The cattle pen shown is made up of Passenger Platforms and Paled Fencing and with some of the Farmyard Animals in it has a very realistic appearance.

Turning now to the track itself, there is the question of the provision of ballast. Its use makes a vast difference to the appearance of the line, and is very effective in reducing the noise made by the trains. Permanent tracks present no difficulties, fine granite chippings being laid down and prevented from spreading untidily by a thin strip of wood along the line. Some prefer to mix the ballast with a solution of glue and water before laying it down, so that it sets hard and retains its position. Obviously such a procedure is out of the question for a temporary line, but a satisfactory substitute is to be obtained under the name of "Linovent," a sheet material sold to place under linoleum. It may be cut into strips and placed under the rails and, as it is surfaced with cork chippings, it imitates ballast very well and of course prevents undue noise. For layouts that are changed frequently separate pieces may be cut for each standard rail length.

1 : 70 Scale

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Each of our competition agents will receive a sterling silver hall-marked "SKYBIRD" Efficiency Cup, which will be awarded for the most realistic photo of "SKYBIRD" models set out as an aerodrome (on the lines of our illustration), a flight formation or a combat. The models must be assembled by the competitor. Only "SKYBIRD" Model Aeroplanes and Hangars are to be used, but competitors may make other additions so as to secure an effective picture, such as Trees, Figures, Buildings, etc. Photographs must not be touched up.

Photographs are to be mounted on the entry card and handed to our agents by January 20, 1933.

SIR ALAN COBHAM, K.B.E., A.F.C., and Capt. W. E. JOHNS, Editor of "Popular Flying," have kindly consented to act as judges.

The "Efficiency Cups" winning photographs will be eligible for the "All-in Cup Competition," the winners, Junior and Senior, will each receive a cup and a prize of One Guinea.

The results will be published in the March issue of "Popular Flying" which will be on sale, February 20, also "Meccano Magazine," March issue.

"SKYBIRD" CONSTRUCTIONAL SETS—"Puss Moth," 1/6; Hawker "Fury," Blackburn "Segrave," Sopwith "Camel," Lockheed "Vega," "Fokker" DVII, price 2/– each.

The "SKYBIRD" HANGAR, 3/6.

"SKYBIRD" Models are the right size for your 0 Gauge Railway Display.

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Suggested Hornby Train Improvements

A FIRE FOR THE FOGMAN

The season of fogs is popularly supposed to commence this month, and we immediately think of the dislocation of traffic that can be produced by thick fog, which is one of the worst enemies of the railway. The familiar bangs caused by the explosion of fog signals or detonators placed on the line to warn the trainmen remind us of the fogmen who have to attend to these detonators and to indicate by lamps or flags the state of the semaphore signals near which they are stationed. The fogman is accommodated in a small hut, in front of which a brazier or fire bucket blazes cheerfully. The items contained in the Hornby Railway Accessories Set No. 7 consist of a miniature fogman's hut, together with a brazier and a shovel and poker to enable the fogman to keep a satisfactory fire going.

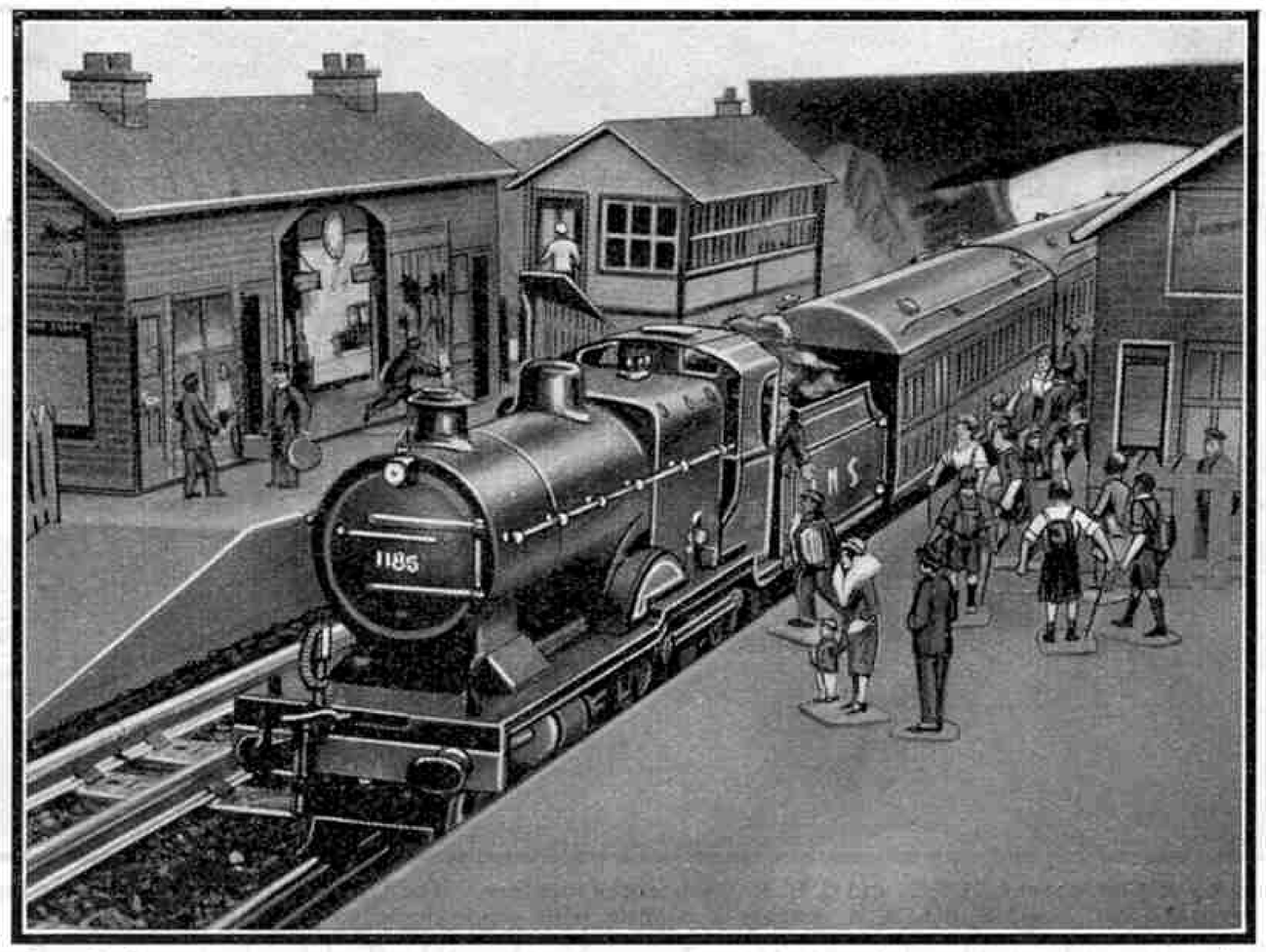
The imitation fire provided in the brazier is quite effective in appearance, but we think that many Hornby Railway owners may care to follow up a scheme that involves the fitting of a flashlamp bulb to the brazier, with a suitable covering to enable the cheerful glow of blazing coke to be reproduced. The first step is to remove the imitation fire, which may be accomplished by a little judicious pushing from below. The miniature bars at the bottom of the brazier should be turned upward slightly, and their tips scraped to remove the enamel. Those who are able to solder may now fit a flashlamp bulb into the brazier, the turned-up bars forming a holder, and contact being made with the metal side of the bulb. One leg of the brazier should be scraped at the bottom end, and wires should be soldered to this and to the metal tip of the lamp, their other ends being led to the terminals of a flashlamp battery. A small switch may be interposed if desired.

Those who cannot solder will have to make use of the Meccano Bulb Holder. This is so placed that its open end is just above the tips of the turned-up bars, and the lamp is gently screwed into it. The usual insulating washers and 6B.A. Bolt are used, but the length of the latter will make it necessary to drill a hole in the railway baseboard to accommodate it, unless it is possible to cut the Bolt short. For portable railways a good scheme will be to mount the hut and brazier complete on a piece of wood, the necessary hole being pierced in the latter to avoid damage to tables or floors. Connections are made from the contact Bolt and from one leg of the brazier as before, the wires being arranged as unobtrusively as possible in order to disguise the electrical part of the scheme.

To cover up the bulb a small piece of red crepe paper should be arranged over the top of it and round inside the brazier. If crepe paper is not available, tissue paper stained with red ink may be used. Whichever scheme is adopted, dabs of black paint or ink should be made on the red surface in order to produce a dappled red and black effect. When the bulb is lighted up a cheerful glow is produced in the brazier, and this gives a very realistic effect, especially in the dark.

The provision of a miniature fogman is the next question. The Guard of Modelled Miniatures No. 1 is probably the most suitable figure available, as he holds a flag in his left hand. His short coat may not be considered exactly warm enough for fogging duty, so that keen readers may experiment with Plasticine in order to lengthen it, finishing it off with a little paint. Similar steps may be taken with his cap to produce any type of head gear that may be desired, as uniform caps are not usual for fogmen. The green colour of his flag may perhaps be objected to, as a red flag is displayed by the fogman when the train is required to stop. However, on a miniature railway the trains will for the most part be passing in the usual way, so that the green flag, signifying "line clear," will be satisfactory.

As may be imagined, a very realistic scene may be fixed up in this manner, the fogman standing outside his hut flagging the trains by, with his cheerful brazier in front of him. The shovel and poker should stand near by for stoking purposes, and a hand lamp—a locomotive headlamp will do—may be placed on the floor of the hut for emergency use.



A realistic scene on a Hornby Station. The various figures, both railwaymen and passengers, give a remarkable impression of the activity that is witnessed on the arrival of a train.

THE M. SERIES STATION SET

Not the least attractive of the numerous accessories now available are the various components making up the M. Station Set. These have been specially produced to be in keeping with the generally simple character of the M. Train Sets, and to enable owners of such outfits to obtain realistic effects on their lines without the necessity of using the larger and more elaborate accessories of the Hornby Series.

The M. Station itself can be used very effectively in conjunction with M. Series Trains, and has in its favour the fact that it does not take up much space. For Hornby Trains of the No. 0, No. 1, or larger varieties this M. Station will be found very useful for branch lines, either as a passing station or a simple country terminus.

Then there is the M. Wayside Station. This is very useful for a halt on any kind of layout, and is simpler in its general equipment than the M. Station. It may well form a "platform" halting place, such as are found in thinly-populated districts, where trains call only occasionally as required.

The M. Signal Cabin is a useful accessory that has quite an effective appearance. It is of small design, so that it can be fitted in awkward places on layouts. It is what we may term a "half model," so that it may be placed up against a retaining wall, and thus enable a Signal Cabin to be provided in a position where it could not be fitted in the ordinary way. For use on ordinary station platforms it is quite suitable, and two placed back to back make an effective complete cabin. For controlling movements in an extensive locomotive or goods yard the M. Series Cabin is very suitable, and keen readers will no doubt find many other uses for it. The M. Series Telegraph Poles and Signals have been referred to recently in the "*M.M.*" so that it is not necessary to say much about them here. Their simple character is in keeping with the other components of the Station Set, but this does not prevent them from being used on more elaborate layouts, where large numbers of them may be required.

KITCHEN AND DINING CAR UNITS.—Suggestions for such units reach us regularly, but we cannot consider their introduction at present. It must be remembered that refreshment facilities are provided on board Pullman Cars, which are well represented in the Hornby Series. As regards the railway companies' rolling stock, considerable use is now made of centre corridor coaches for dining purposes, and this type of vehicle has its miniature counterpart in the Hornby No. 2 Saloon Coaches. The advantage is that a whole train may be served with meals without the passengers having to leave their seats to proceed to the dining car, as tables are fitted in the coaches themselves. To imitate a kitchen car or the kitchen portion of a dining car you may adopt the suggestion, that has been made several times in the "*M.M.*," of placing a strip of tracing paper between the celluloid "windows" of the No. 2 Saloon Coach and the sides of the vehicle. This gives the "kitchen window" effect that you mention. (*Reply to B. Lawton, Birmingham.*)

A MINIATURE HORSE-BOX.—A horse-box such as you suggest would be a useful addition to the rolling stock of the Hornby Series. This and several other vehicles of a similar kind have been engaging our attention for some time, and no doubt their introduction will take place in due course. We note with interest that you are at present using a Guard's Van as a horse-box, but the actual loading of a miniature horse can hardly be carried out through its double doors. (*Reply to T. Gibson, Wendover.*)

GANTRY CRANE FOR GOODS YARDS.—We doubt whether an elaborate model of this kind would be popular among Hornby Railway owners, as only extensive goods yards are provided with cranes of this kind. In any case a gantry crane can readily be constructed from Meccano parts and may be designed to fulfil the particular conditions of your layout. (*Reply to R. Bell, Shrewsbury.*)

VARIABLE SPEED DEVICE FOR CLOCKWORK LOCOMOTIVES.—Your proposal is of interest, and we agree that it would be very fascinating to vary the speed of a clockwork locomotive according to the class of work required of the engine. We have experimented in this direction, but we are of opinion that the increased price necessary for the provision of such special apparatus would not meet with the approval of most Hornby Train owners. The limitations of space also on a Gauge 0 Locomotive of normal design are serious, and make the matter one of some difficulty. (*Reply to S. Fisher, Peterborough.*)

XLVII.—THROUGH SERVICES AND CONNECTIONS

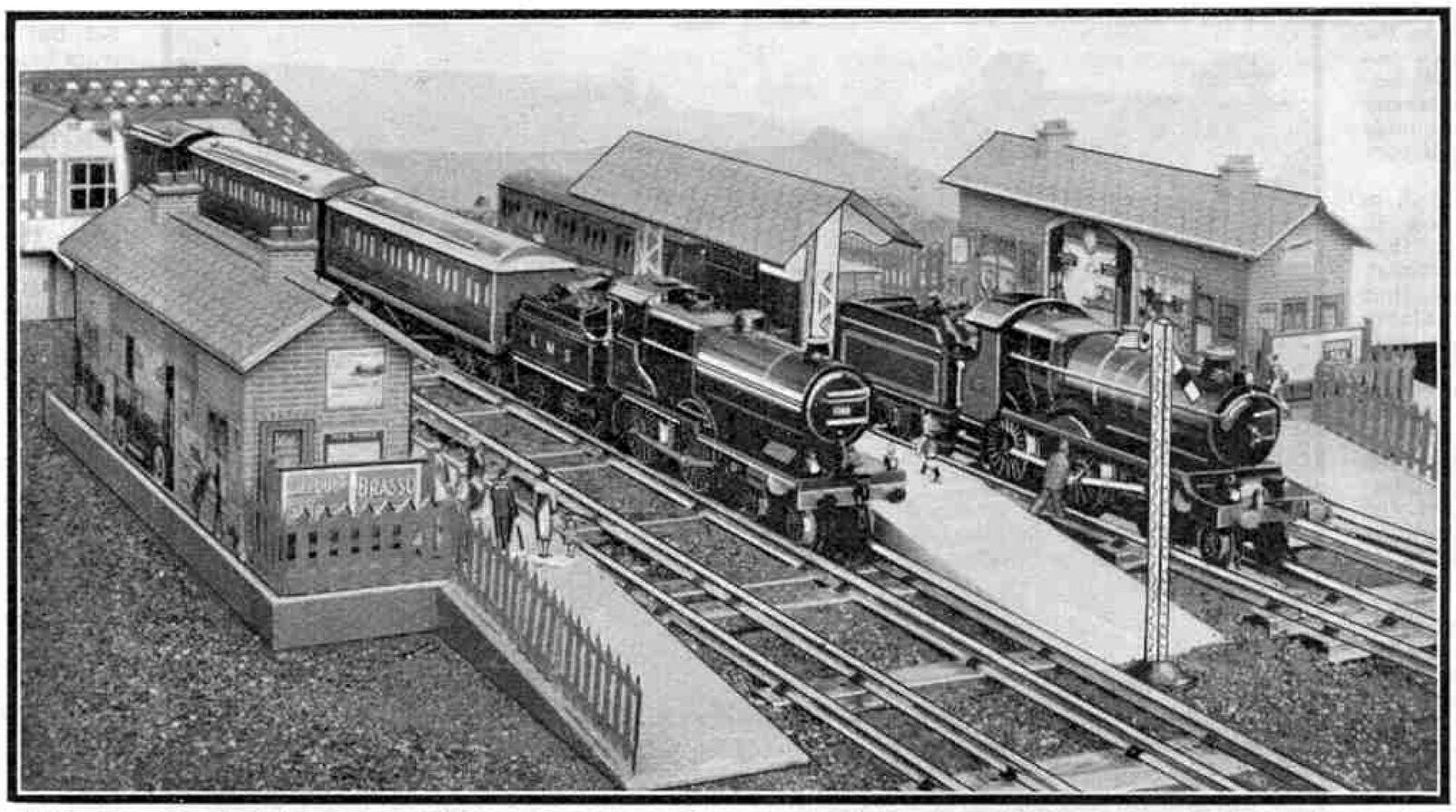
MOST model railway enthusiasts have a favourite group or section of a group, the practice of which they endeavour to reproduce as far as possible in the layout, operation and equipment of their own lines. This following of actual conditions makes the railway more interesting, not only to the owner or operator, but also to visitors, who will immediately recognise certain features as those they are familiar with during their daily travels. This of course gives a much better impression of the possibilities of a miniature railway than a miscellaneous collection of locomotives and rolling stock, all operated on a haphazard basis with no real plan behind it all.

It is possible, however, when due consideration is given to the various items that are obtained for the line, to operate a very interesting series of trains when the locomotives and rolling stock of several companies are in service together. Joint or connecting working of this kind can be extremely fascinating, and there are of course numerous examples that may be followed from actual practice, where the locomotives and carriages of two or more companies are involved in the operation of through coaches and even through trains that give useful facilities between places far apart. Such schemes are found attractive by quite a number of H.R.C. enthusiasts, and in the case of Branches where members contribute material there is bound to be considerable variety of stock, so that a plan of this kind is necessarily followed.

In the days of the numerous independent companies there were a great many through services, but these were considerably curtailed during the War. Post-war reconstruction and the grouping of the old companies has extended the practice, and some remarkable services are now operated. In many cases where the distances are great and more or less roundabout routes have to be followed for connecting purposes, the timings may not appear striking, but the convenience of the through service and other considerations makes up for the comparative slowness.

The longest through-coach journey in the British Isles is the remarkable Aberdeen to Penzance service over a distance of 795 miles, operated by the G.W.R. and L.N.E.R. companies. Although only a single through coach is run, it is conveyed by trains that have restaurant or sleeping accommodation, and G.W. and L.N.E.R. stock is used alternatively. Such an interesting example of through working, with the limits of its run indicated on destination boards, would be a very fascinating part of the operation of a miniature system. "Aberdeen and Penzance via Edinburgh, York, Sheffield, Leicester, Swindon and Plymouth" is a remarkable indication on a coach roof board, and would have to be suitably shortened for miniature purposes. The L.N.E.R. main line is left at Culworth Junction below Rugby, while from Banbury Junction to Swindon and beyond the G.W.R. metals are used. Thus L.N.E.R. or G.W.R. miniature systems that include any portion of the route followed may quite well make a feature of the operation of this through service. A Hornby No. 2 Saloon Coach may be used as the L.N.E.R. vehicle, while the G.W. representative may be a No. 2 Pullman, the brown and cream finish of which is not unlike the G.W.R. livery. On less elaborate layouts No. 1 Coaches will no doubt be used.

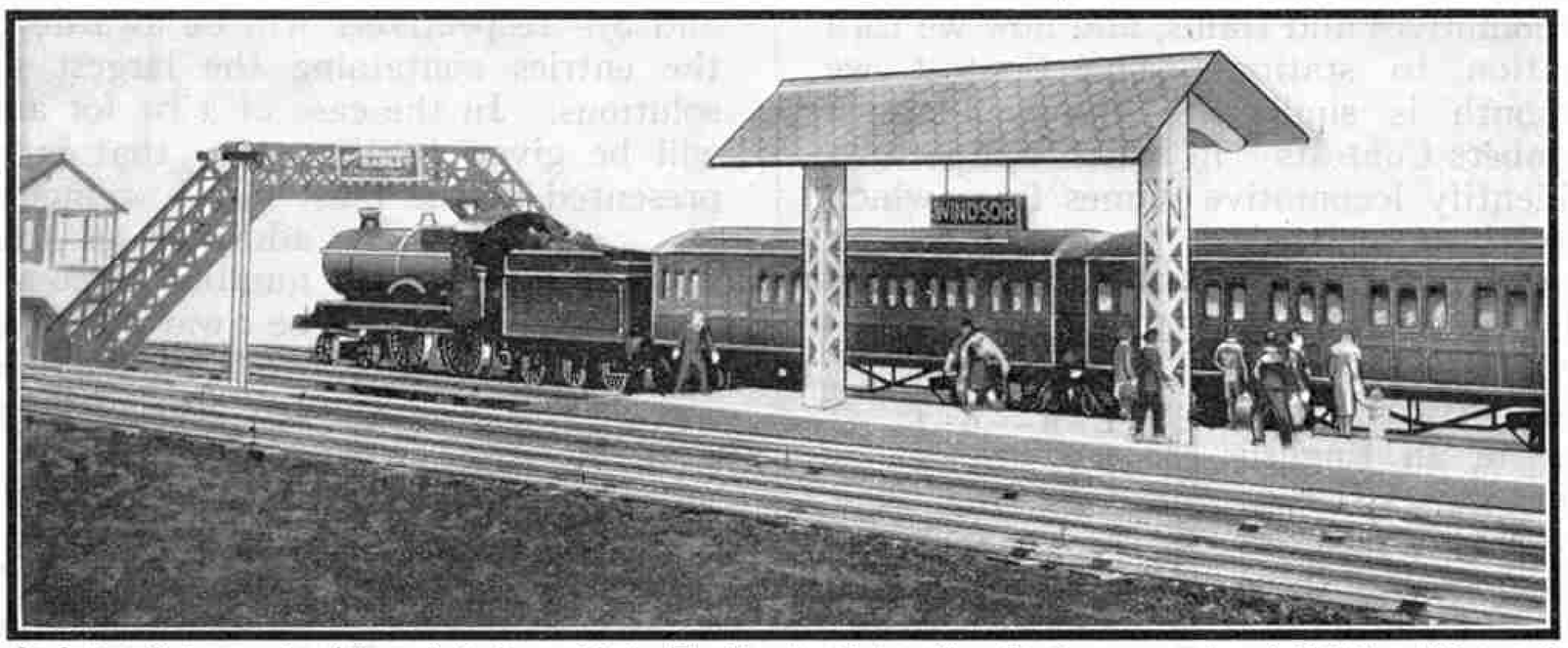
More interesting still will be the modelling of the station where the locomotives are changed—in this case Banbury—so that L.N.E.R. and G.W.R. engines may be used together on the same layout. Similar exchanges take place between the G.W.R. and S.R. in the running of the through restaurant car services between Birkenhead



A jointly-operated station where L.M.S.R. and G.W.R. stock works together. The L.M.S.R. express train is passing through, while a G.W.R. engine is dealing with some empty vehicles.

and Bournemouth. In this case Oxford is the point where the S.R. locomotive takes charge to run the train via Reading and Basingstoke and so on to the Southern main line. Here again rolling stock is provided on alternate days by each company.

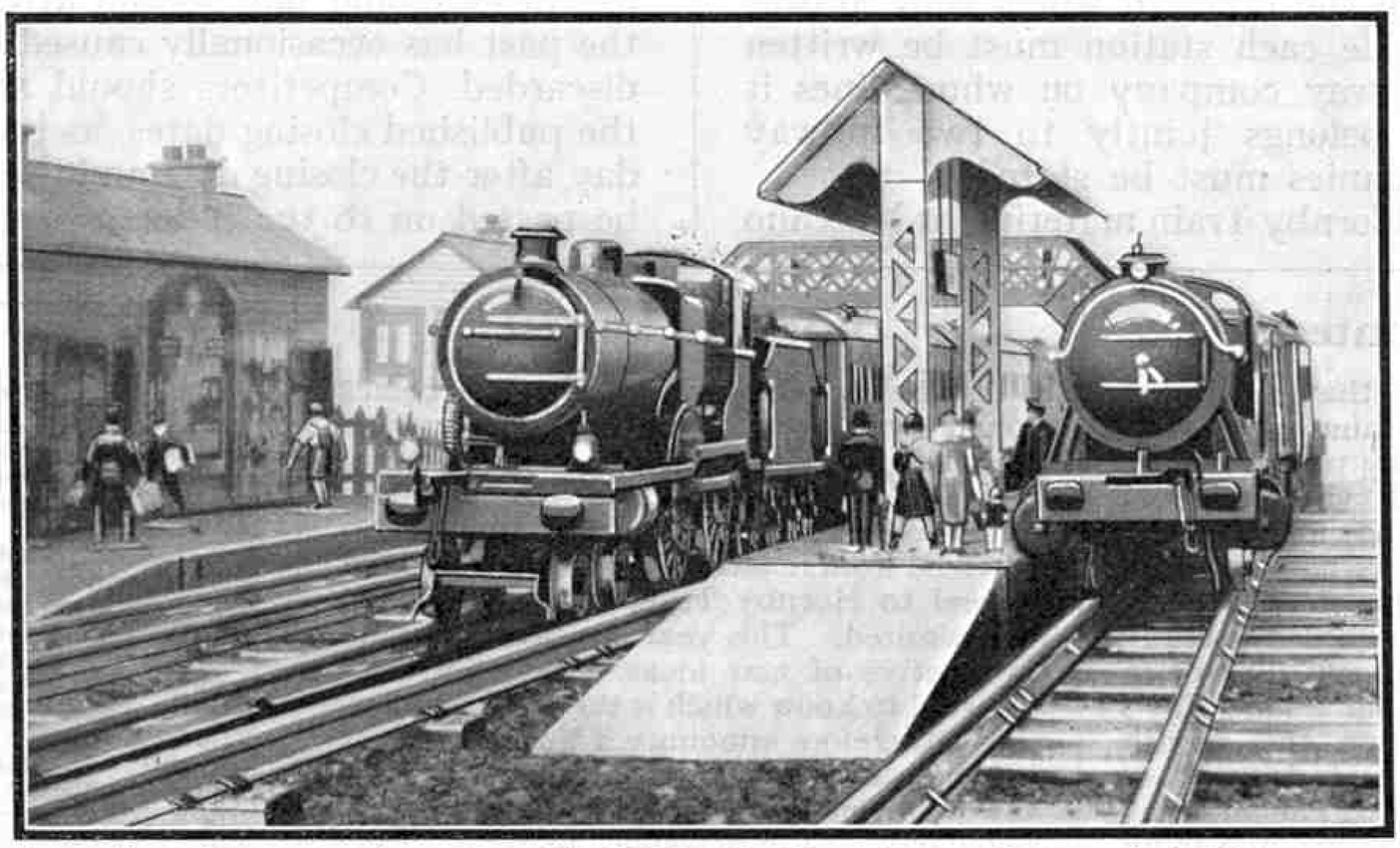
Another instance of inter-working between the L.N.E.R. and G.W.R. companies is the "Ports-to-Ports Express" described in the July, 1929, *"M.M."* This is run between Newcastle and Barry, outside Cardiff, and the rolling stock used is provided alternately by each of the companies concerned. An interesting feature of the make-up of this train from Newcastle to York is that L.M.S.R. coaches for Bristol are also conveyed there and L.N.E.R. local vehicles, so that when Great Western stock is in use for the through portion for Barry, three of our great groups are represented in one train. Those who are keen on such mixtures of rolling stock as this will find plenty of scope for it in running a miniature Newcastle to Barry service. The upper photograph on this page shows a Hornby G.W.R. "County" Locomotive at a station with a train of Metropolitan vehicles. These, used as L.N.E.R. coaches, make up quite an interesting miniature representation of the "Ports-to-Ports Express."



An interesting example of through train working. The Hornby Metropolitan Coaches are used as L.N.E.R. vehicles, and with a G.W.R. locomotive make up a train such as the "Ports-to-Ports Express" referred to in this article.

Readers will remember that we referred recently in these pages to the running of "The Sunny South Express," particularly over the West London and West London Extension Railways between the L.M.S.R. main line at Willesden Junction and the S.R. system. The operation of this train, Southern-hauled to and from Willesden on its northward and southward journeys respectively, provides a great opportunity for joint working. The West London line itself, as pointed out in the July *"M.M."* of this year, is as interesting a system in this respect as can be found anywhere, and its operation will no doubt appeal to those who favour this kind of traffic working.

Among other interesting cross-country services are those operated by the L.M.S.R. and L.N.E.R. between Liverpool and Hull and between Liverpool and Newcastle. Leeds New Station, where the L.N.E.R. take charge, is a joint station, so that the engines and rolling stock of both companies are commonly seen. Assuming that a miniature layout is arranged on similar lines, an interesting point will be the comparisons that may be made between L.M.S.R. and L.N.E.R. locomotives, such as the Hornby No. 2 Special representatives of these companies. Both are 4-4-0 engines and both have outside cylinders, but whereas the L.M.S.R. one has the usual form of slide-bars and crosshead, the L.N.E.R. has a special pattern of each; but the cylinders are not of the same shape, nor do they have the forward extension, known as the tail rod guide, found on the L.M.S.R. engine. The latter has a Belpaire firebox with a flat top, whereas the L.N.E.R. engine has a round-top boiler, and this is neatly lined out, in contrast to the plain appearance of the L.M.S.R. one. Both cabs have the roof extended at the rear to afford additional protection, but the form of each is different, as are the cabs themselves. The L.N.E.R. cab is a two-window structure, as now standard on that line, whereas that of the L.M.S.R. is distinctly of the Midland design originated at Derby.



Connecting trains at a junction station. The L.M.S.R. No. 2 Special Locomotive has arrived with an express, while the No. 1 Special is waiting for the transfer of passengers and their luggage to the stopping train.

Each engine has a raised footplate; but whereas that of the L.M.S.R. is only raised up to clear the coupling rods on top centre, that of the L.N.E.R. rises up before the cylinders and continues raised until the cab is reached. The deep buffer beam of the L.M.S.R. engine is characteristic, and explains the small extent to which the raising of the footplate is carried out, whereas the L.N.E.R. locomotive, having a normal buffer beam, requires a substantial rise in the footplate to clear the cylinders and the connecting and coupling rods.

A striking difference is found in the colours in which these two engines are finished. The L.N.E.R. engine is finished in the standard light green of that company, and well lined out, whereas the L.M.S.R. livery is the familiar Derby red, with rather less decoration in the shape of lining.

The L.M.S.R. and G.W.R. work jointly in numerous instances, so that their engines may appear together in many circumstances. Birkenhead, Chester and Shrewsbury provide well-known examples of this, and G.W.R. engines are even found at that essentially L.M.S.R. centre Crewe. The G.W.R.

(Continued on page 860)

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries, should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

"HIDDEN STATIONS CONTEST"

WE have already tested our readers' knowledge of famous locomotives and trains, and now we turn our attention to stations. The Contest we announce this month is similar to the well-known "Names and Numbers Contests" in which competitors are required to identify locomotive names from which various letters have been omitted.

In the panel in the centre of this page are 24 words in which dashes represent missing letters. Each of these queer-looking words forms part of the name of an English railway station, and we set H.R.C. members the pleasant task of identifying the names of these stations. There is no catch in any of the words; in spite of appearances each one will be found to form part of the name of a railway station. Some of the stations are large ones on main lines, others are less well known; but all are to be found without difficulty in "Bradshaw" or other railway timetables.

P--d-n-to-	T--nc--pe-
-ra-t--m	-w-nw--k
L-n--o-t	-at-o-
Fa--r-ha-	Walt---
-w-yt-l--g	-w--to-
-w-lhe--	C--n-f---
B-ac--e-l	F--tw-c-
-an-i--t--e	Car-----
A--i-s-o--	Ha--b-i-ge
S--rl-y	-l-db--y
W-xf--d	--acke--ton-
-n-re--o-o-g-	-e-en-a-s

When competitors have discovered all the correct stations, or as many of them as they can find, they must make a list of them in the order in which they appear in the panel. Alongside each station must be written the initials of the railway company on whose lines it lies. If the station belongs jointly to two railway companies, both companies must be stated.

Prizes consisting of Hornby Train material (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the entries containing the largest number of correct solutions. In the case of a tie for any prize preference will be given to the entry that is neatest or that is presented in the most novel or ingenious manner. In addition to the main prizes, a number of consolation prizes will be awarded to the entries which, while below prizewinning standard, are nevertheless praiseworthy efforts to tackle the Contest.

Envelopes containing entries must be clearly marked "*H.R.C. Stations Contest*" in the top left-hand corner, and posted to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 30th November. The closing date for the Overseas Section is 28th February, 1933.

Every entry submitted for this Contest must be clearly marked with the sender's name and full address and H.R.C. membership number. Failure to observe this condition will result in disqualification. This is an important feature to which members should pay special attention, as its neglect in the past has occasionally caused promising entries to be discarded. Competitors should send their entries before the published closing dates, as judging takes place on the day after the closing date and those received after cannot be passed on to the judges.

Drawing Contest

The huge locomotives that haul our passenger and goods trains are such familiar features that many people simply take them for granted without ever stopping to consider how they are prepared for a day's duty. There is no danger of H.R.C. members doing this, for they frequently pay visits to engine sheds and study locomotives when they are off duty or in the course of preparation for a hard day's work. For our competition this month we offer prizes for the best drawing of "*An Engine Shed Scene.*" The drawing may depict any scene that is common to an engine shed, such as cleaning, coaling, etc.

Prizes consisting of Hornby or Meccano goods to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four most correct entries received in each section—Home and Overseas. In the event of a tie for any prize, preference will be given to the entry that is neatest. In addition to the main prizes a number of consolation prizes will be awarded to those boys whose entries show painstaking efforts.

Envelopes containing entries should be clearly marked "*H.R.C. Engine Shed Drawing Contest,*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 30th November. The closing date for the Overseas Section is 28th February, 1933.

Voting Contest

As the model railway "season" comes round each year Hornby Train owners watch eagerly for the fresh items that are included in the System. These introductions are developed from suggestions received from readers, and their widespread appeal to Hornby Train owners is therefore assured. This year has been specially productive of new ideas, and we are interested to know which is the most popular.

We therefore announce a Voting Contest in which each entrant is required to place the following new items in their order of popularity:—Countryside Sections, Cuttings, Fabric Tunnels, Miniature Passengers, Animals, Hall's Distemper Advertisement, Miniature Train Set, Cadbury's Chocolate Van, Fencing with Four Trees and Accessories fitted for Electric Lighting. Illustrations of these will be found in recent "*M.M.'s*" or the latest Catalogues.

The entrant's name, address and H.R.C. number must be added at the end of the list, which should be addressed to "*H.R.C. November Voting Contest,*" Meccano Ltd., Binns Road, Old Swan, Liverpool.

Prizes of Hornby Train or Meccano goods to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the four winners in each section—Home and Overseas.

The closing dates are, Home Section, 30th November; Overseas Section, 28th February, 1933.

COMPETITION RESULTS

HOME

August "Mutilated Names Contest."—First: F. Spaven (1022), Edinburgh, 12. Second: W. R. S. Smart (1502), Harrow. Third: J. F. Aylard (25864), London, N.14. Fourth: R. Lumley (20253), Plymouth. Consolation Prizes: K. D. Rhodes (17633), Hayes, Middx.; E. C. Burrage (7037), London, N.4; E. A. Taylor (25924), N. Harrow; P. S. Hale (14692), Wolverhampton; R. S. Pike (21989), Birmingham; H. J. Allwright (8864), London, W.5; C. W. Foster (26961), Southall, Middx.; H. S. North (929), Farnham, Surrey; D. Holder (8613), Leicester; P. G. Perry (25771), Lewes, Sussex; E. H. Corrall (27621), Enfield Wash, Middx.; A. R. Cockell (22721), Brentwood.

August "Questions Contest No. 4."—First: A. Robinson (24997), Manchester. Second: J. A. Saunt (2264), Coventry. Third: H. J. Vincent (4210), Coulsdon. Fourth: R. Barbary (5580), Mevagissey, Cornwall. Consolation Prizes: N. W. A. Raxworthy (5899), London, S.E.9; J. G. Spence (27737), Caterham; M. G. Murray (23480), Bramble Hill, Hants.; D. J. Lewer (6892), London, N.16; H. Maasch (23994), Hove; C. W. Lex (14033), Kingston-on-Thames; L. C. Darby (25760), Manchester; R. C. T. Lyle (30157), Hereford; H. Sosnowick (11640), Manchester; W. K. Tomlinson (10007), Blackpool; K. E. Milburn (26029), Chingford, London, E.4; A. F. Milburn (16322), Chingford. London, E.4.

OVERSEAS

May "Rolling Stock Contest."—First: J. W. Boyes (9959), Wellington, N.Z. Second: W. Jack (8958), Australia. Third: A. Abdulrahim (10438), India. Fourth: J. H. Neville (23636), Australia. Consolation Prizes: F. L. Bingen (28995), Wyk-Maastricht, Holland; J. Farrie (30032), Wyk-Maastricht, Holland.

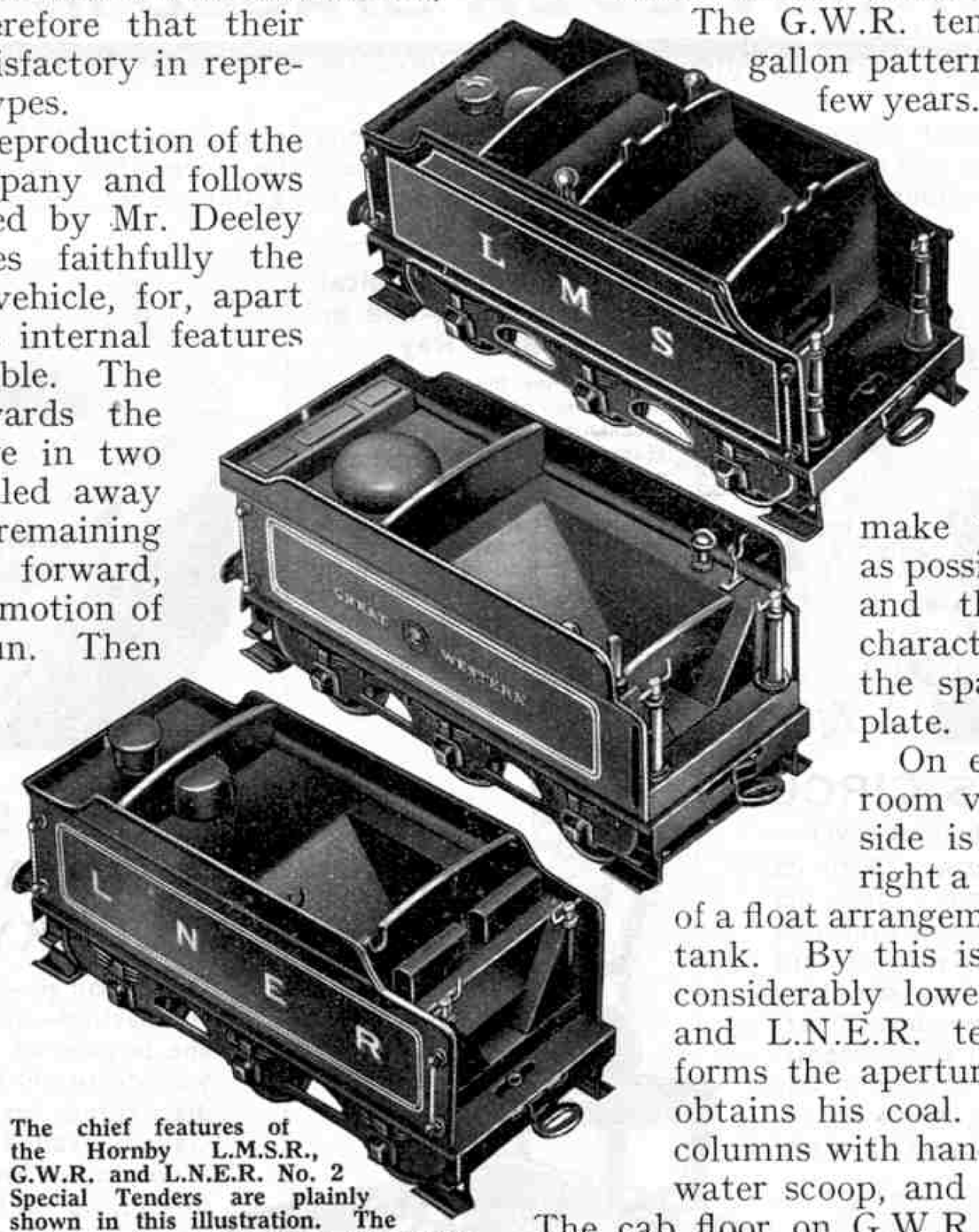
May "Missing Words Contest."—First: G. A. Christos (29787), Johannesburg, S.A. Second: H. R. Hondelink (25394), Holland. Third: R. Garcia (23445), B.W. Indies. Fourth: A. Arthur (24176), Australia. Consolation Prize: J. D. Torrance (10842), Cape Province, S.A.

Some Features of Hornby Tenders

By "Tommy Dodd"

FROM time to time the various locomotives of the Hornby Series have been dealt with on this page. Little has been said about the tenders that run with many of them, however, so I have decided to make tenders my subject for this month, with particular reference to those of the No. 2 Special variety. Readers will remember what a great step forward was taken when the No. 2 Special Locomotives were introduced, and it was only fitting therefore that their tenders should be equally satisfactory in representing certain definite prototypes.

The L.M.S.R. example is a reproduction of the standard tender of that company and follows the flat-sided design developed by Mr. Deeley on the M.R. It reproduces faithfully the characteristics of the actual vehicle, for, apart from its general contour, the internal features are included as far as possible. The tank top slopes down towards the front, which is an advantage in two ways. As the coal is shovelled away at the bottom of the slope, the remaining fuel tends to work its way forward, assisted by the slope and the motion of the tender when on the run. Then again the plain pattern of the tank allows internal inspection and repairs to be carried out easily. On the flat portion of the tank is the manhole or filler. This allows of access to the inside of the tank—by slim members of the locomotive department only !—and of course its function is to receive the "bag" or pipe of the water column or tower for filling purposes.



The chief features of the Hornby L.M.S.R., G.W.R. and L.N.E.R. No. 2 Special Tenders are plainly shown in this illustration. The S.R. example is not included, as it closely resembles the L.M.S.R. vehicle.

Next there is the water pick-up dome. This is situated above the pipe leading from the "dip" or scoop below the tender, and its function is to divert into the tank the water rushing up the pipe when the scoop is lowered over the troughs. The heavy cast dome takes the shock that otherwise would be sustained by the tank top. The next feature of interest is the division plate extending from side to side. This marks the limit of the coal space, and keeps the coal within bounds. Then there are two vent pipes with "mushroom" tops. These act as air releases when water is entering the tank, and if too much water is taken in they "weep" rather freely.

Near these is another division on which vertical prongs are formed near the centre. Between these prongs and the corresponding two on the front division plate the pricker and other fire irons are accommodated, the usual practice being to stack these tools with their round handles over the front prongs and their business ends lying between the others. This brings us to the front division plate. There is an opening in it at a convenient height, and so the fireman is able to shovel his fuel comfortably. At the front of the tender are two columns on which are mounted the handles controlling the tender hand brake and the water scoop.

It is hardly necessary to devote much space to the S.R. tender, as this is of the flat-sided six-wheeled pattern, and except for the lack of the pick-up dome and air vents is made in the same way as the L.M.S.R. example.

The G.W.R. tender is modelled on the 4,000-gallon pattern developed during the past few years. Unlike the flat-sided L.M.S.R. example the sides are flanged out at the top to meet the coping. The tank arrangement is similar, except that water legs are a feature, and these are made to slope down towards the centre of the tender, in addition to the slope of the main portion of the tank, so as to make the tender as self-trimming as possible. The filling arrangements and the large pick-up dome so characteristic of G.W. tenders occupy the space behind the rear division plate.

On each of the water legs mushroom vents appear, while on the left side is a pricker rack, and on the right a water gauge showing by means of a float arrangement the amount of water in the tank. By this is the front division, which is considerably lower than that on the L.M.S.R. and L.N.E.R. tenders. The space below it forms the aperture through which the fireman obtains his coal. There are at the front two columns with handles, the left-hand one for the water scoop, and the right for the hand brake. The cab floor on G.W.R. engines is high, so that the tender front is arranged to correspond, as the illustration shows.

As regards the elevation of the sides, the L.N.E.R. tender resembles the L.M.S.R., but the top edges are flanged outward and the coping is, as it were, built up upon this portion. In this respect it resembles the G.W. tender, as it does also to a certain extent as regards the arrangement of the water tank. The rear division plate is near the filler, and in fact it straddles the water pick-up dome. A sloping tank and water legs ensure self-trimming of the coal, and at the front end is the neat and convenient arrangement that is clearly shown in the illustration. Two lockers are accommodated on a "shelf," protected from the piled-up coal behind them, while below is the outlet whence the fireman shovels his fuel. Brake and scoop handles are mounted on the front end of the tanks, and provision is also made for the fire irons, the division plate being cut away to form a rest for them, while a rack is fitted in a suitable position a short distance along the tank.

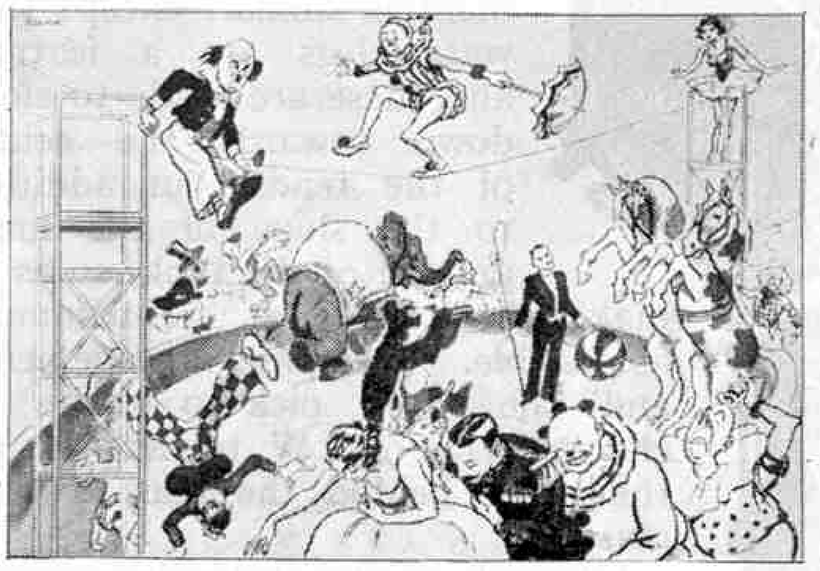
Wonderful Attractions For You at GAMAGES

BEGINS NOVEMBER 21ST

XMAS BAZAAR

THE FINEST EVER STAGED IN BRITAIN

Here are a few of the attractions which you will see at the greatest Christmas Show in town. But space will not permit us to tell you of a thousand others . . . of the marvellous array of toys, the working models, the decorations, and the joyous carnival spirit which prevails throughout the Store. But, of course, you have already decided to come along and see for yourself what a wonderful Show it is.



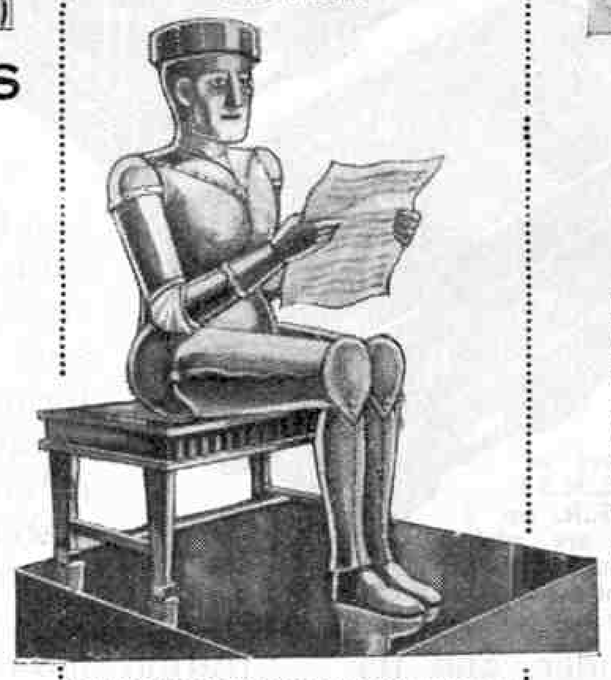
CHAPMAN'S FAMOUS CIRCUS

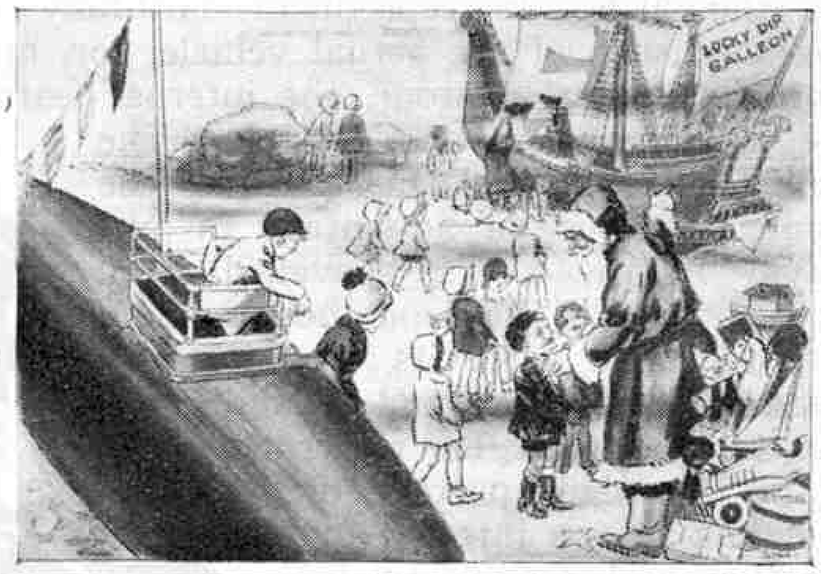
Bigger, Funnier and More Daring than Ever—The Greatest Bazaar's Greatest Show. With its Equilibrist, Equestrienne and Jugglers' acts, its trained animals, and the funniest Clowns ever, it is essentially a Show that every Boy and Girl will want to see. Mirth provoking and daring—one long round of sheer joy. Thrilling as it was last Christmas, it is even better this year, and undoubtedly, it is the finest Show ever staged by a Store in this country. Admission by ticket only, price 7d. including tax. Performances, 2, 3, 4, 5, and 6 o'clock. Tickets obtainable at Box Office : Ground Floor.

Circus in full swing Nov. 21.

The Famous Mechanical Man and Infra-Red or Invisible Ray

Two Mighty Marvels that all must see to believe. The Mechanical Man is almost Human—it Talks, Answers questions and Moves like you and I. The amazing power of the Invisible Ray is an astounding demonstration of where Science is leading us. See it working Vacuum Cleaners, Electric Lamps and also controlling the movements of the Mechanical Man. DEFINITELY A SHOW YOU REALLY MUST SEE.





BY SUBMARINE TO SANTA CLAUS AND THE LUCKY-DIP GALLEON

Down you go—just like those brave men in the *real* submarines—only *you* are safe. When you come to the bottom of the ocean, you cruise around until you locate old Santa Claus who, this year, we have discovered, has taken up his quarters on a sunken Galleon—called the " Lucky Dip." How he found it we do not know ; but we do know that, instead of *gold*, he has found thousands of fine Toys, which he will *give* to every Boy and Girl who makes the trip.

THE MOST POPULAR CHRISTMAS CATALOGUE IN THE WORLD—FREE TO YOU

PUBLISHED MID-NOVEMBER

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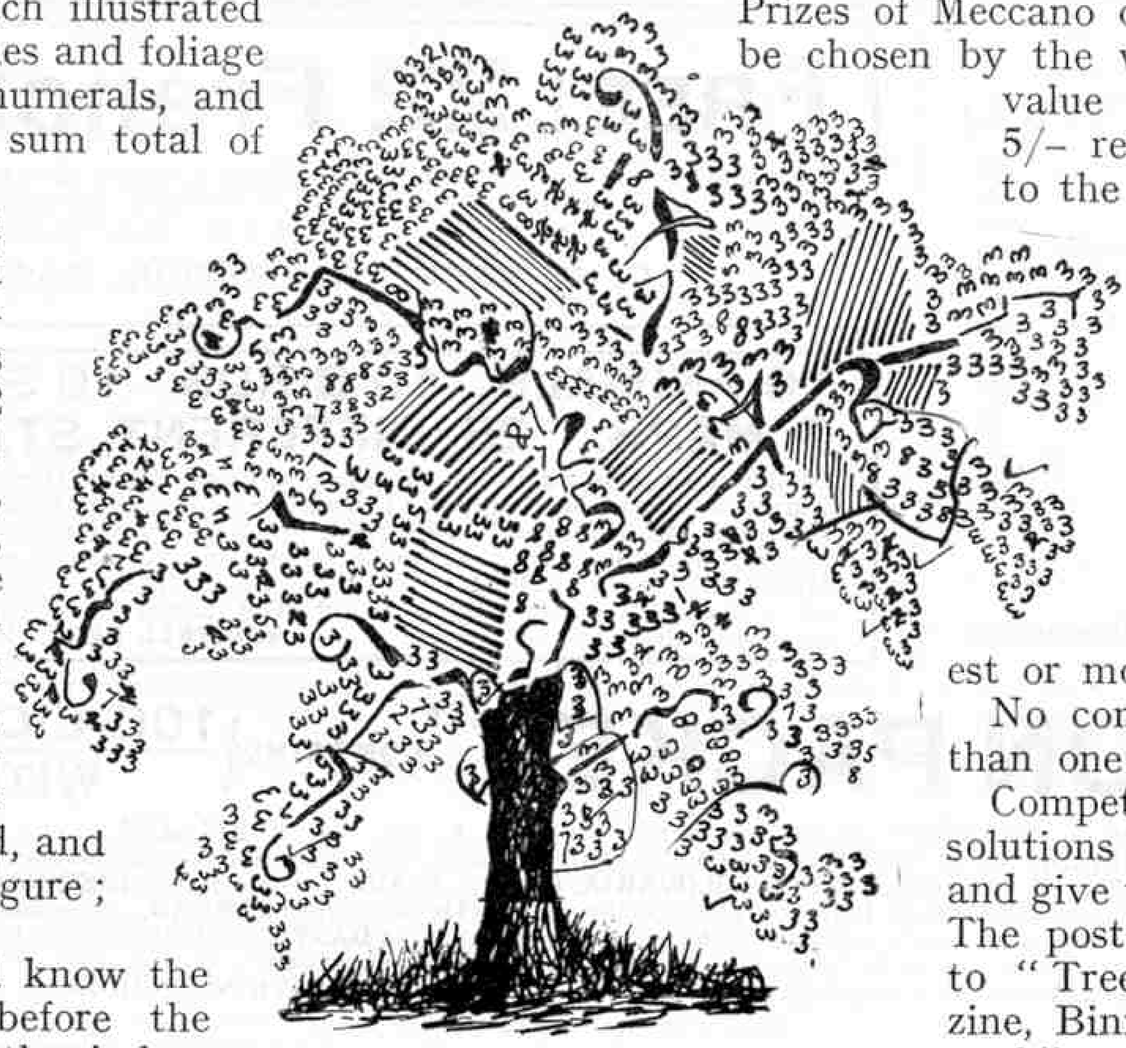
Competition Page

TREE FIGURES : ANOTHER EYE TEASER

Some years ago our readers found considerable enjoyment in some eye-teasing figure puzzles that were produced on this page, and as a result of many requests we are setting another puzzle of the type. Close examination of the sketch illustrated here will reveal that the branches and foliage of the tree consist solely of numerals, and the puzzle is to discover the sum total of those numerals.



It should be explained that each figure is to be counted separately; there are no combinations of two or more figures to make numbers such as 12 or 123. Only the figures 1 to 9 are employed. Some, of course, are upside down, and others are just a little eccentric in their construction. The sixes and nines must be scrutinised carefully, but it will facilitate identification if it is explained that the curl of the nines is closed, and joins up to the stem of the figure; that of the sixes is open.

To ensure that no one shall know the exact total of the figures before the closing date, the Editor and the judges each erased a figure from the sketch before it was reproduced. No one knows which figure the others took out; the answers to that question are in sealed envelopes in the Editor's desk. At the close of the contest these envelopes will be opened and the total of the figures disclosed will be deducted from the original total in the drawing, to give the correct figure.

Prizes of Meccano or Hornby Train goods (to be chosen by the winners themselves) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four nearest estimates, in order of merit. In addition there will be a number of consolation prizes for those whose entries come next in order. In the event of a tie for any or all of the prizes, preference will be given to those entries showing the neatest or most novel preparation.

No competitor may submit more than one entry.

Competitors should write their solutions clearly on a post card, and give their full name and address. The post card should be addressed to "Tree Figures, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must be sent to reach this office not later than 30th November. A duplicate set of prizes is reserved for Overseas competitors, whose entries must arrive not later than 28th February, 1933.

The Most Interesting Advertisement

The advertising pages of this month's "*M.M.*" are full of interesting announcements from our advertisers. Many of their offers are in the nature of bargains; all of them offer sound value. We are not concerned on this page with boosting our advertisers, however, but with a simple competition in which readers are invited to state which advertisement they consider to be the most interesting, and why.

All advertisements, large and small, stamps and readers' sales, are to be considered, of course. Prizes of goods to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded for the four best letters setting forth the reader's view of the advertisement he selects as the most interesting. The goods may be selected from the lists of any advertiser in the magazine—not necessarily from the advertisement quoted, it should be observed.

Letters should be addressed "Advertisement Letter, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must arrive not later than 30th November.

Similar prizes are offered to Overseas readers whose entries must arrive not later than 28th February, 1933.

November Drawing Contest

In our last issue we announced an experimental Drawing Contest—for drawings of any subject that individual readers might care to submit. To give this experiment an opportunity to justify itself we intend to continue it for two further months, November and December. There will be a separate contest for each month, and the prizes will be awarded to the best drawings received, irrespective of their subjects. Paintings are eligible, of course.

The entries will be divided into two sections as usual, A for those from readers aged 16 and over, B for those from readers under 16, and prizes of Meccano products or drawing materials, to be chosen by the winners, to the value of 21/– and 10/6 respectively, will be awarded to the best and second-best entry in each section. In addition there will be a number of consolation prizes.

Entries sent this month should be addressed "November Drawing Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must reach this office not later than 30th November.

Similar prizes are offered for competition among Overseas readers, whose entries must arrive not later than 28th February, 1933.

COMPETITION RESULTS

HOME

August Photo Contest.—First Prizes: Section A, B. Currie (Clydebank); Section B, A. E. Crampton (Birmingham); Second Prizes: Section A, A. Martin (Birmingham); Section B, G. Bedward (London, N.22). Consolation Prizes: R. J. S. Booty (Sydenham, S.E.26); F. Burnett (Welling); Miss D. Burton (Caterham Valley); P. F. M. Caverdale (Birmingham); L. Hollyoak (Coventry); R. W. Newby (London, W.4); G. H. Preston (London, W.13); W. Raybould (Bloxwich).

Holiday Drawing Contest.—First Prizes: Section A, H. Davis (Bristol); Section B, T. R. Simm (Charlton, S.E.7). Second Prizes: Section A, A. E. Lukey Camden Town, N.W.1); Section B, L. Tipler (Tipton). Consolation Prizes: W. S. Butcher (Coventry); E. W. Ennion (Plumstead, S.E.18); C. Evans (Douglas); B. M. Garbett Winchester); S. B. Hopkin (Oswestry); R. F. C. Lowndes (Ipswich); A. McDonald (Edinburgh); D. Ralph (Herne Bay).

OVERSEAS

May Photo Contest.—First Prizes: Section A, J. Credie (Capetown); Section B, J. Street (Sydney); Second Prizes: Section A, F. Van Bulck (Brussels); Section B, M. Fuinsinger (East London, S. Africa). Consolation Prizes: F. D. Arig (Bombay); C. Carrel (Taranaki); L. A. Seton (Montreal West); E. M. Turner (Christchurch).

April Photo Contest.—First Prizes: Section A, J. Credie (Capetown); Section B, D. Courlander (East London, S. Africa); Second Prizes: Section A, K. T. Khandwalla (Karachi); Section B, L. A. Seton (Montreal West). Consolation Prizes: C. J. McCain (Sydney); E. M. Turner (Christchurch).

Type Designs.—1. A. H. Trollip (Johannesburg); 2 W. G. de Gauberville (Enschede, Holland); 3. H. R. Evans (Buenos Aires); 4. S. F. Desai (Bombay). Consolation Prizes: G. C. Gera (Sliema); J. R. Heeramaneck (Bombay).

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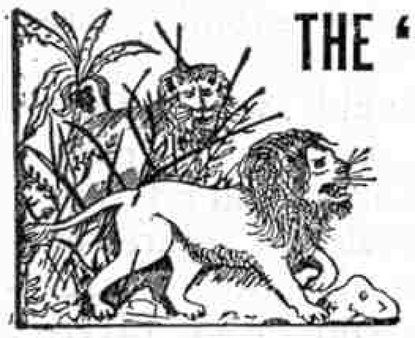

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Every stamp in this unique packet **has a lion on it.** A fine Set of **BELGIAN** (lions), Set of **Bavaria** including pictorial officials, Set of **ESTHONIA,** Set of **NEW ZEALAND** (Victory pictorials), Set of **14 Norway** and **Sweden,** including officials, Set of **Denmark** (with 20 lions), **PERSIA** (lion with sword), **CZECHO-SLOVAKIA,** Bulgaria, **SPAIN,** commemorative **IBERO-AMERICANA,** Set of **16 FINLAND,** new issue, etc. (usually sold at **1/4**), and a fine pictorial **SORUTH** surcharged **SARKAR.** Price **5d.,** postage 1½d. extra. Purchasers of this packet asking for sheets will be presented with a beautiful Set of **DANZIG** (including high values to 500,000M. **FREE**). (20 lions making a total of 120 lions with the packet), this Set alone usually sells at **10d.** A free Set of stamps will also be given to all who send addresses of stamp-collecting friends.

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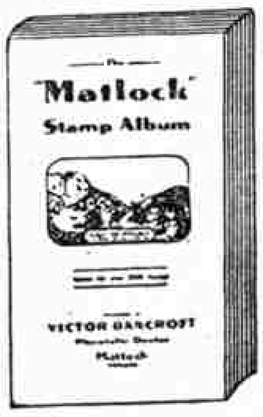

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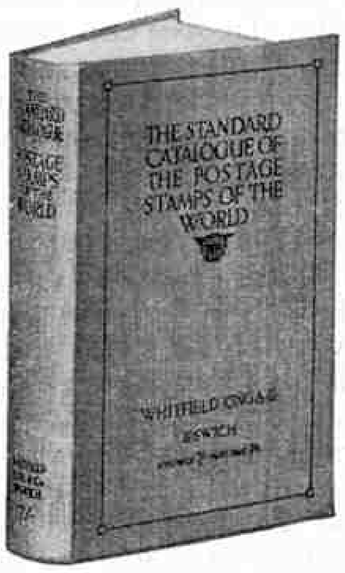

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WRITING UP THE STAMP COLLECTION

NEXT to good display, nothing adds so much to the value and interest of a stamp collection as good "writing up." Just as a collection of good but untitled holiday snapshots is of little interest to a stranger, so the unwritten-up collection of interesting stamps fails to communicate its fascination to the non-collector.

There are, of course, degrees of writing up, ranging from the brief statement of the essentials—issue date, watermark and perforation—to a full description of all the circumstances of the issue, details of the design and a philatelic history of the issuing country. The latter extreme involves an enormous amount of research, and it is a task that only the leisured could contemplate with any degree of equanimity, and then only in regard to one or two favourite countries.

Greece, 1927. 10 dr. Prizes are offered for a full writing up of this stamp. For details of the competition see the concluding paragraphs of the accompanying article.

Canada, 1927. 60th Anniversary of Confederation. Perf. 12.

It is essential, therefore, for each individual to decide in advance just how far he is prepared to carry his writing up, and in doing so it would be advisable to err on the side of brevity. The writing up must be consistent throughout the collection, and by limiting the amount of data to be given, a reasonable standard may be maintained throughout.

The purpose of this article is not to lay down hard and fast rules that must be observed, but to suggest material that may be included. It will be for the collector to adopt or reject our suggestions as his personal taste dictates.

We have already indicated what we consider to be the bare essentials—the date of issue, the watermark and the perforation. The collector who takes only these has, as it were, skimmed the cream of the stamp and presented it for rapid easy digestion. We may, then, treat these three facts as the basic structure of the writing up, and build upon them.

Consideration of the issue date immediately suggests several important questions. Why was this new stamp issued? For how long was it in use? How many copies were printed? Was more than one die used to prepare the printing plates? What was the nature of the printing paper used? From these main questions subsidiary ones, each of importance, follow automatically. What relationship has the design to the circumstances of the issue? What portion of the quantity printed was actually issued for use, and what was the method of disposal of the balance? If the period of use was lengthy, were there any variations in the shade of the printing ink used? Were there any variations in the separate dies made or in the printing plates prepared from those dies?

If each of these questions with its supplementaries is set out as a heading for enquiry, the extent of the field of research is revealed in no uncertain manner, and the importance of pre-determining the limits to be covered is made obvious.

Up to this stage we have considered individual stamps. In dealing with a complete issue certain points will be common to every stamp in the issue. This detail should be classified as "general" and placed at the head of the page devoted to the issue. Matter relating to the individual stamps of an issue should appear immediately above or alongside the stamp itself, and it cannot be emphasised too strongly that every note so placed—excepting the completely trivial—adds to the interest. For example, small arrows indicating the exact position of errors, plate varieties, etc., would prove a very valuable addition to the descriptive matter.

Neatness in the actual writing and in the arrangement of the notes is just as important to the ultimate interest of the collection as the degree of completeness of the data provided. It is immaterial whether script, block lettering or a decorative style is adopted, provided that uniformity and easy reading is ensured. It is rarely possible to achieve these objects in an ornate style of writing that does not come naturally, and we recommend the adoption of simple, straightforward lettering.

Decorative lettering may be used at the head of the page—for the name of the country or the distinguishing title of the issue—but only those who are really skilful should attempt it. Colours should be used very sparingly, and as a general principle we would exclude them from the descriptive data. A good black ink, used with a fine, but not scratchy, mapping pen, cannot be improved upon. The stamps themselves may safely be left to provide all the colour relief required upon the page. For the page headings and any necessary subtitlings, broad and medium pens may be employed with good results; they have the effect of controlling the size of the writing performed with them.

Gold Coast, 1st August, 1928. Perf. 13½×15. Wmk. Multiple script CA.

Norway, 1925. Amundsen Polar Flight Commemorative. Perf. 14½×13½. Wmk. Posthorn.

Finally, before a single word is committed to the album, the actual wording of the complete writing up should be decided upon. It is very disappointing after taking great pains to achieve neatness, to discover that the phrasing and sequence of data leaves something to be desired.

To encourage readers to consider the possibilities and advantages of a written-up collection, we offer prizes for the best writing up of the Greek 10 dr. stamp illustrated with this article. The writing up should be as complete as possible, but the entry may be submitted in any form that the reader's personal inclinations dictate.

There will be four prizes, consisting of stamps or stamp collecting equipment (to be chosen by the winners from the lists of "*M.M.*" advertisers) to the value of 21/–, 15/–, 10/6 and 5/– respectively, for the best four entries in order of merit in each of the two sections, Home and Overseas. In addition there will be a number of consolation prizes.

Entries in this competition should be addressed to "November Stamp Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must reach this office not later than 30th November. The Overseas closing date is 28th February, 1933.

Newfoundland, 3rd January, 1928. Publicity issue. Perf. 14.

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Free to Genuine Approval Applicants.

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For further stamp advertisements see page 908

Stamp Gossip

Notes on Recent New Issues

The 1933 Catalogues

The outstanding feature of the new season's catalogues is the considerable revision of prices necessitated by Britain's departure from the Gold Standard in the autumn of last year. This affects the foreign sections principally, but the upward movement has been accentuated by a well-maintained demand for good stamps. Depressions may come and intensify, but the interest in stamp collecting continues unabated, a wonderful testimony to the fascination of the hobby.

Messrs. Whitfield King give their usual interesting résumé of philatelic figures. During the past year 1,738 new stamps have been issued, 121 more than in the preceding year. Of these new stamps Europe was responsible for 563, Asia 373, Africa 241, America 394, the West Indies 39 and Oceania 128. With these additions the total number of stamps issued to date, as included in the Whitfield King catalogue, amounts to 55,214. Europe is responsible for 17,314 of these, Asia 10,103, America 9,339, West Indies 3,251 and Oceania 2,794. Of this huge total of stamps the catalogue illustrates no less than 6,274.

The Whitfield King catalogue is unquestionably an ideal guide for the young collector, for it includes only major varieties. Full details of the catalogue, which can be obtained from any stamp dealer or direct from Messrs. Whitfield King & Company, Ipswich, price 7/– (7/6 post free), will be found in our stamp advertising columns.

When using the Gibbons' catalogue in past years it has been a frequent occurrence to pick up an old volume instead of the current one owing to the similarity in binding. An important innovation in the present edition is a band of colour, bearing the date, running round the cover and spine. Future volumes will have the colour of the date band altered, and it is hoped thus to provide a system that will make identification of each edition a simple matter.

Quite apart from the price alterations due to the causes already indicated, many interesting revisions have been made possible as a result of Messrs. Gibbons' acquisition of the Dorning-Beckton collection and the Lincoln stock. Many "out of the way" stamps appear in these and their presence has afforded an opportunity to price them on an "in stock" basis.

As usual the catalogue is divided into two parts; (1) The British Empire and (2) Foreign Countries. These parts may be obtained separately and are priced at 6/6 and 10/– respectively (postage in the U.K., 5d. and 9d. extra; Overseas 8d. and 1/–). Bound as one volume the price is 15/– (post extra U.K. 9d.; Overseas 1/3).

The Gibbons catalogue is an essential to the advanced collector, for it records every known variety. Any stamp dealer can supply this ideal Christmas present for a stamp collector, or it may be obtained from Stanley Gibbons Ltd., 391, Strand, London, W.C.2.

Death of Santos Dumont

An echo of our March, 1930, article "*Airways are Mailways*" is provided by the death of Alberto Santos Dumont, one of the great pioneers of aviation.

Santos Dumont's aeronautical career was dealt with in our Editorial in the September "*M.M.*" We need not refer to it again except to comment that his achievements were justly commemorated when Brazil decided to base the designs of the country's current air stamps on incidents in his career.

We reproduce the 200 and 500 reis values of that series. The former shows Santos Dumont's 12 h.p. airship rounding the Eiffel Tower in the course of a flight from St. Cloud to Paris and back that occupied less than 30 minutes on 19th October, 1901. For this flight Santos Dumont was awarded a prize of £4,000. The 500 reis stamp shows Santos Dumont's box-kite-like biplane making its first flight in the vicinity of Paris on 12th November, 1906.

A Censorship of Stamps

An interesting sidelight on the publicity value of stamp designs is cast by recent protests submitted to the Secretariat of the Postal Union at Berne. The coffee-producing states of South America have combined to take exception to Guatemala's air mail stamps bearing the slogan "Guatemala produces the best coffee in the world," while Bolivia has objected to the inclusion of the disputed Gran Chaco territory on the Paraguayan "map" stamps.

At the present time the Postal Union has no power to censor debatable stamp designs, but it is not improbable that the matter will come up for discussion at the next Congress.

* * * *

Newfoundland has added three new stamps to the current general issue described in the March, 1932, "*M.M.*" The most interesting of the new stamps is a 7 cent illustrated here, showing a portrait of the Duchess of York. The others are essentially industrial in character. The 8c. provides a view of the paper mills at Corner Brook, while the 24c. shows a large freight steamer loading iron ore at Bell Island. This island is in Conception Bay near St. Johns, and should not be confused with the more famous Belle Island.

The colours of four of the existing series have been changed, these being the 1c., 2c., 4c. and 5c. values, which are now grey, green, rose-carmine and bright purple respectively.

We thank Stanley Gibbons Ltd. and Messrs. Lisburn and Townsend for their courtesy in loaning the stamps from which the illustrations or our stamp pages have been made.

Ottawa Conference Commemoratives

Canada's stamps commemorating the Ottawa Conference are a disappointing lot; not one of the three designs can be called a success.

The failure of the 13 cents "double size pictorial" is well summed up by Gibbons' Stamp Monthly, which comments—"the stamp is actually objectionable and for this reason. It is intended to commemorate the conference of the members of the British Empire, but the figure in the centre is more French than 'La France.' The Phrygian cap has become associated with the republican the world over."

The portrait of the King on the 3 cent stamp seems to have been over-engraved, with the result that the picture is that of a man very much older than His Majesty.

We illustrate the 5 cent stamp which bears a portrait of the Prince of Wales. It is the best of the bunch, but even so it is not satisfactory for the design seems to have been based upon an old portrait.

San Marino Honours Garibaldi

For the second time in eight years San Marino has issued a Garibaldi commemorative stamp series. One may be forgiven perhaps for wondering to what extent the second issue is inspired by a refusal to be outdone by Italy, which also has honoured the great patriot's memory this year.

San Marino's issue consists of eight denominations ranging from 10c. to 5L. There are two designs. The one issued for the four lower values shows a portrait of Garibaldi and embodies a transcription of the famous "Order of the Day" of 31st July, 1849. The second design shows the arrival of Garibaldi and his followers at the gates of the city where they sought asylum from the Austrians.

* * * *

To commemorate the 5th centenary of the discovery of the Azores, Portugal is to issue a special series of stamps in favour of which the present Lusiad stamps will be temporarily withdrawn from circulation. The new commemorative series will use six historical designs, of which five have already been decided upon. These are as follows:—Portrait of Prince Henry the Navigator; Joal de Regras, a Portuguese chronicler of the Middle Ages; Portrait of General Carmona, the present President of Portugal; Ruins of Roman Temple of Evora; Town of the Clerigos Church at Oporto.

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There are special Australian, New Zealand, South African and Canadian editions, which may be obtained from Meccano dealers in these countries at the following prices :— AUSTRALIA, Price 2/–. NEW ZEALAND, Price 1/–. SOUTH AFRICA, Price 1/–. CANADA, Price 25 cents.

Readers living in countries other than those mentioned above should order from Meccano Ltd., Old Swan, Liverpool, England, sending a remittance of 1/2 with their orders.

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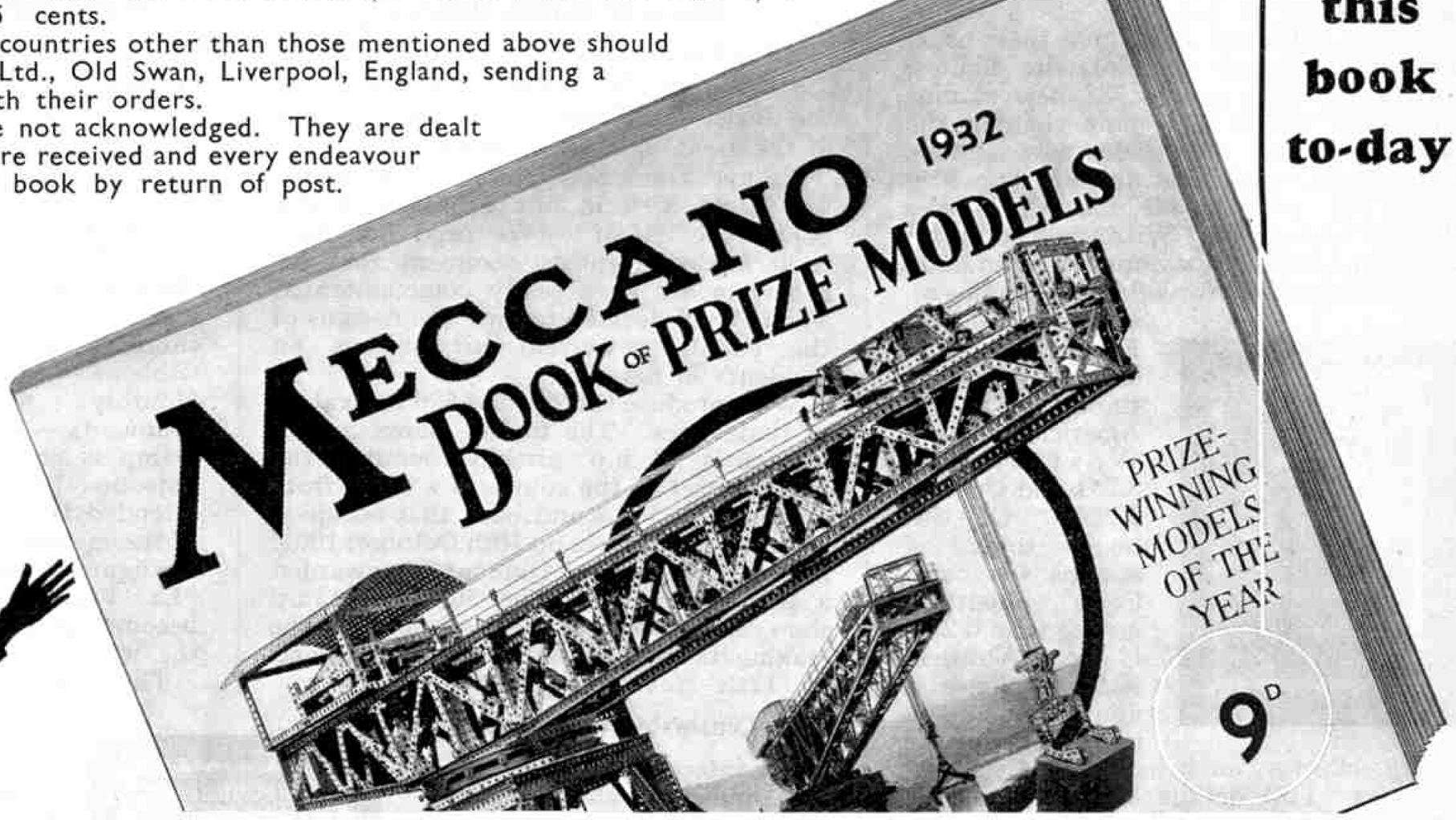

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KIA-ORA

LEMON, ORANGE AND GRAPE FRUIT SQUASHES

A glass of Squash—Lemon, Orange or Grape Fruit costs less than 1d. because a large bottle costing 2/– makes 25-30 drinks of pure healthful Orangeade, Lemonade and Grape Fruit, simply by adding water.

Sole Makers :—

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FIRESIDE FUN

MISUNDERSTOOD

"But you said that your dog wouldn't bite," expostulated the rambler, whose clothes had been badly torn by a fierce dog.

"And neither will he, zur," returned the yokel. "But my dog be at home. This be Farmer Brown's animal."

* * * *

New convict: "By the way, officer, I always sleep with my door open!"

* * * *

"Did you go to Pompeii, Mrs. Newbroom?" asked Mrs. Gossip.

"Oh yes, and I was *so* disappointed," said Mrs. Newbroom; "the place was very badly in need of repair."

* * * *

Scotsman (to saddler): "One spur, please!"

Saddler: "One spur! What can you do with one spur?"

Sandy: "Well, if one side of the horse goes, the ither will have to gae wi' it."

* * * *

"When I was a small child I was told that if I made faces like that my face would stay like it," said Uncle sternly.

"Then why didn't you stop?" replied his nephew.

* * * *

The master had written 43.56 on the blackboard and to show the effect of multiplying by one hundred he rubbed out the decimal point.

"Now, Williams, where is the decimal point?" he then asked.

"On the duster, sir," replied Williams.

* * * *

"I see you have a notice, 'We Aim to Please,'" remarked the irritated customer.

"Yes," replied the manager, "that is our motto."

"Well," said the customer, "you ought to give your staff a little time off for target practice."

* * * *

The barber thoughtfully surveyed the top of his customer's head. "Hair-cut or polish, sir?" he asked.

* * * *

Father: "Yes, son, that's a man-of-war."

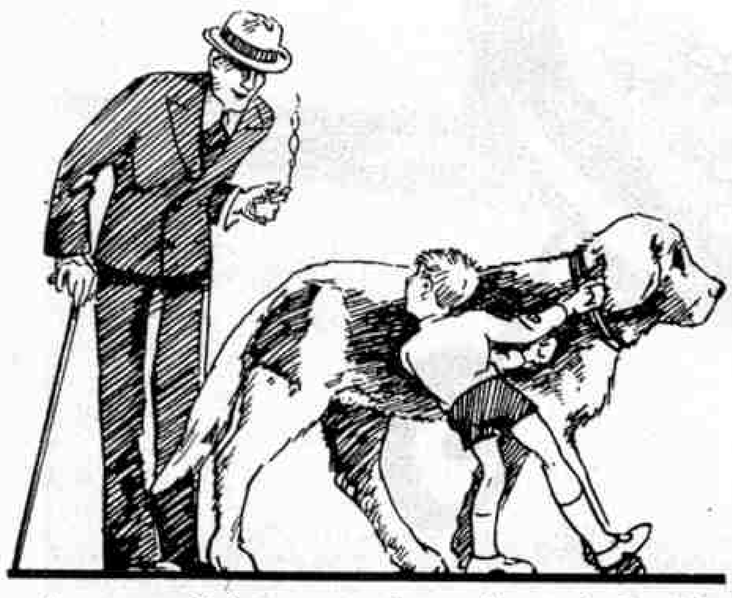
Bright Son: "And what is the little one just in front."

Father: "Oh, that's just a tug."

Bright Son: "Oh, I see, a tug-of-war. I've heard of them, too."

* * * *

THE PHILOSOPHER



A very small boy was endeavouring to lead a big St. Bernard dog along the road.

"Where are you taking your dog, my little man?" asked an amused passer-by.

"I'm going to see where he wants to go, first," gasped the little boy.

* * * *

"Now, Jones, what do you mean by coming to school with your hair in that disgraceful condition?"

"No comb, miss."

"Then why didn't you use your father's?"

"No hair, miss."

A LEAN TIME FOR THE PIGS

Visitor from city: "And tell me, my good man, how do you manage to get your bacon streaky."

Farm Hand (fed-up): "Well, yer see, sir, we only feed the pigs every other day."

* * * *

"Did you know that John is in hospital?"

"What's the matter with him?"

"Oh! he came down a ladder five minutes after it had been taken away."

* * * *

The man caught in the rain was endeavouring to get a taxi.

"Talk about raining cats and dogs," he grumbled, "it's absolutely nothing to hailing taxis."

* * * *

SAFETY FIRST

Inexperienced Mountaineer (pointing from door of hotel): "I'm going to scale that peak to-morrow, and I want your advice. Tell me, what preparations must I make?"

Hotel Proprietor: "You must pay me in advance for your stay, sir!"

* * * *

Jones was spending the week-end with Brown, whose hobby was carpentry.

"By the way," he said, picking up a length of wood in Brown's workshop, "what are these holes?"

"Those are knot holes," Brown explained.

"Oh, yes they are," replied Jones indignantly. "Do you think I don't know a hole when I see one?"

* * * *

Mother: "Sonny, wake up!"

Sonny: "I can't!"

Mother: "Oh, why?"

Sonny: "I'm not asleep!"

* * * *

Teacher: "Is there any word in the English language that contains all the vowels?"

Pupil: "Unquestionably!"

* * * *

First Traveller: "Where I come from, we have the safest railway in the world. A collision on our line is absolutely impossible."

Second Traveller: "Impossible! How's that?"

First Traveller: "We've only got one train."

* * * *

A young man in a Soho restaurant, wishing to show off before his friends, said in a loud voice.

"Waitah! We'll start with some Emilio Spagoni."

The waiter smiled. "Excuse, sir," he said. "But zat ees not to eat. Eet ees ze name of ze managaire!"

* * * *

A Chinaman sold a horse to a farmer, and while the farmer was inspecting the animal, he repeatedly said "Horsee no look well, but plenty pull."

It was subsequently discovered that the animal was blind, and the purchaser sued the Chinaman for the return of his money.

"Did you know the horse was blind?" asked the magistrate.

"Oh, yeh, I know long tam," the Chinaman replied.

"Then why didn't you tell him so?" the magistrate demanded.

"I tell him, alli," said the Chinaman. "I tell him plenty horsee no look well."

OBEYING ORDERS

The village brass band was practising in readiness to play at the village sports, and while playing one rather tricky piece the cornet player, a recruit, ceased blowing.

The conductor glared at him. "Why'd stop, Garge?" he asked.

The cornet player showed the conductor the music sheet. "Well, Mr. Islepotle," he explained, "it do say 'ere, 'refrain,' so I did."

* * * *

Lecturer (in small town): "Of course, you all know what the inside of a corpuscle is like."

Chairman of Meeting (interrupting): "Most of us do, but ye better explain for the benefit of them as have never had the good fortune to go inside one."

* * * *

Maid: "There's no tea left in the pantry, mum."

Mistress: "Why didn't you tell me before?"

Maid: "Because there was some then, mum."

* * * *

Walking through the shop he noticed a nice-looking air-gun.

"What does that shoot?" he asked the salesman.

"Slugs," was the answer.

"I'll have one, then. My garden is full of the beastly things."

* * * *

"Mother, have I been a good boy lately?"

"Yes, Johnny, you have been a very good boy indeed during the last few days."

"And do you trust me, Mother?"

"Why, of course I trust you."

"Then why do you go on locking up the jam?"

* * * *

"You are run down, Mr. Richman," said the doctor. "What you need is an iron tonic."

"Oh, doctor," replied the wealthy patient, "hadn't we better make sure of a cure? I can easily afford gold, or even platinum."

* * * *

Prisoner: "I can prove my innocence, your worship."

Judge: "How?"

Prisoner: "Give me time."

Judge: "Right. Ten years."

* * * *

The town boy was on holiday in the country, and was walking through the woods.

"Oh look!" he said, stopping and picking up a chestnut burr. "I've found a hedgehog's egg!"

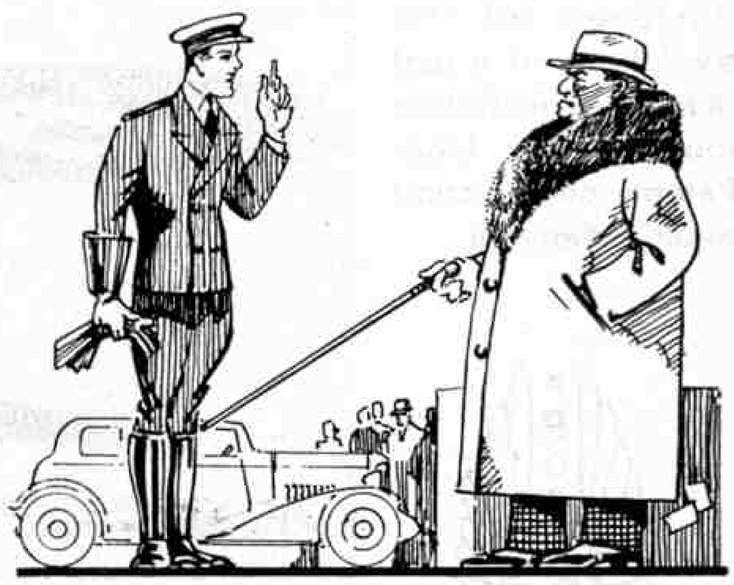
* * * *

Poet: "Do you think I should put more fire into my poetry?"

Editor: "Quite the reverse; put the poetry into the fire."

* * * *

A COMMON TYPE



Angry Guest (to chauffeur): "How is it you've taken so long to find me? Didn't your master describe me to you?"

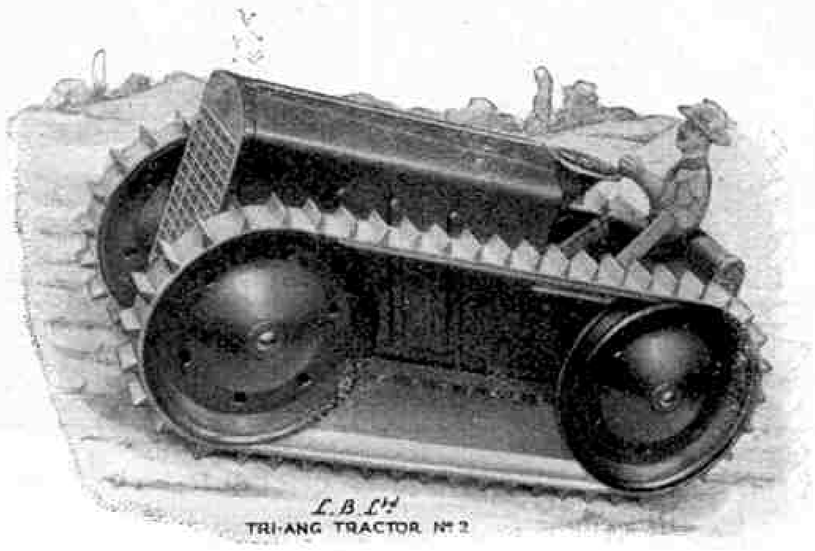
Chauffeur: "Yes, sir, but there were so many fat old gentlemen!"

* * * *

"My dear, I must say that the pudding does not taste very nice."

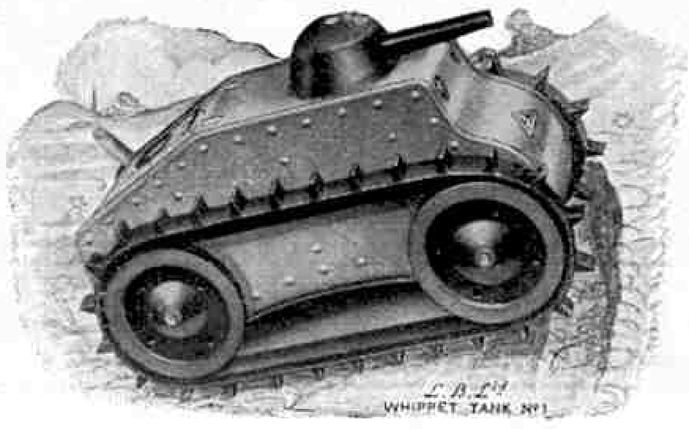
"It must be your imagination. It says in the cookery book that it tastes excellent."

New Tri-ang Powerful Clockwork Toys



TRI-ANG TRACTOR No. 2. - - 3/11d.

Steel construction, cellulose painted red. Reliable motor with control lever. Rubber bands on steel wheels. - - - - - - - - - Length 8½ ins.



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A miniature of a climbing fighting tank. Strong motor, control lever. Swivelling gun turret. Rubber bands. - - - Length 5¼ ins

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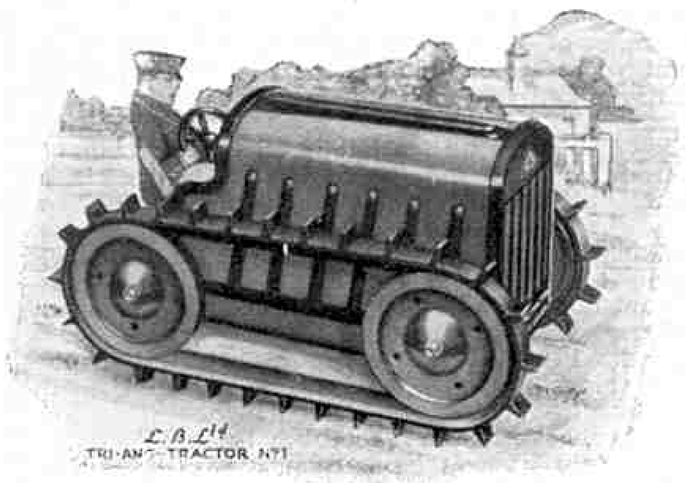

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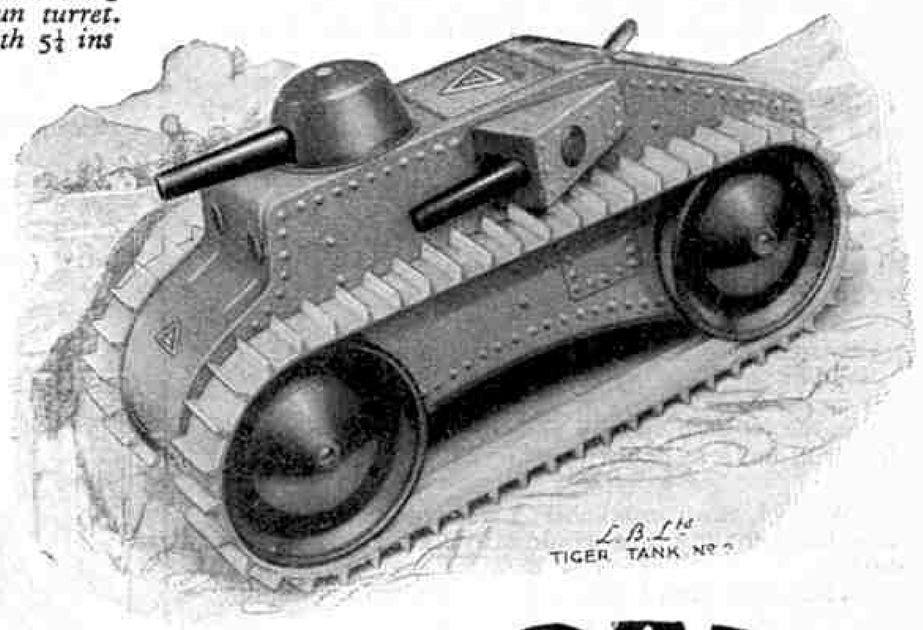
TIGER CLIMBING & FIGHTING TANK No. 2 - - - - - - 5/11

A powerful climber, made of steel, with wide rubber bands. Swivelling gun turret with firing device. Control lever. - - - - Length 10 ins.



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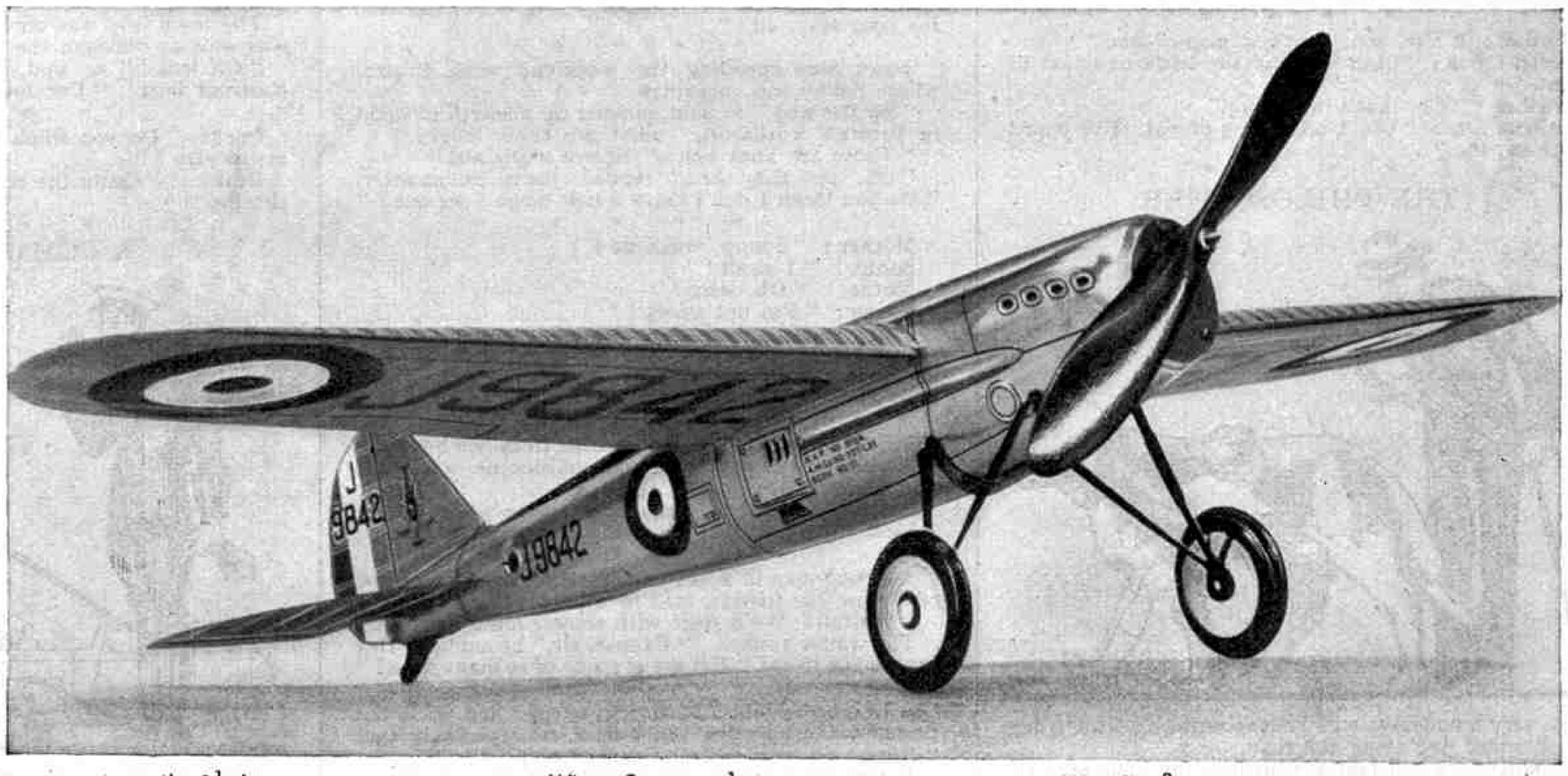

Length 9¼ ins. Wing Span 11½ ins. Weight ¾ oz.

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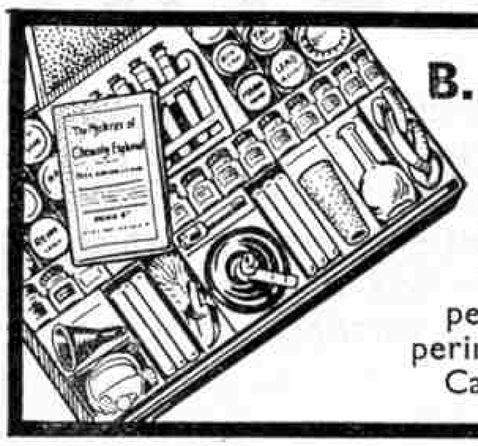
HAMLEYS



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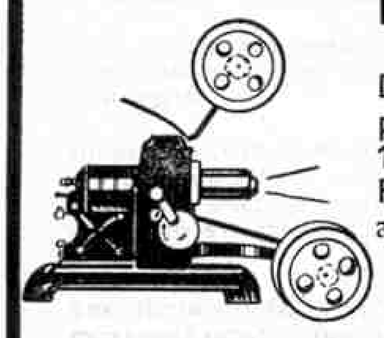

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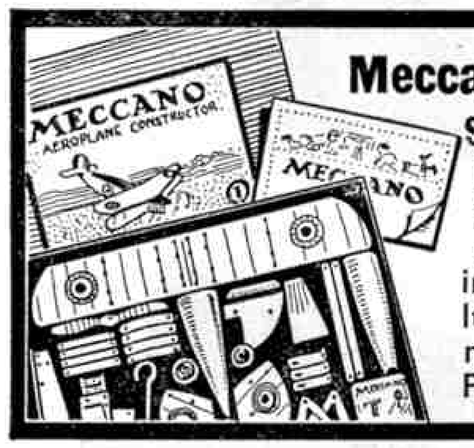

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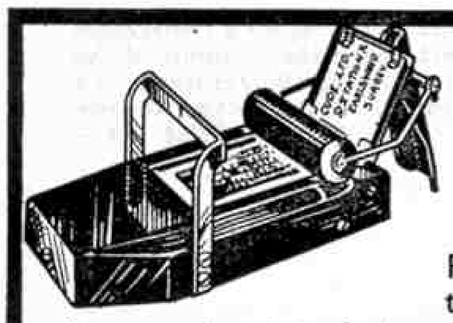

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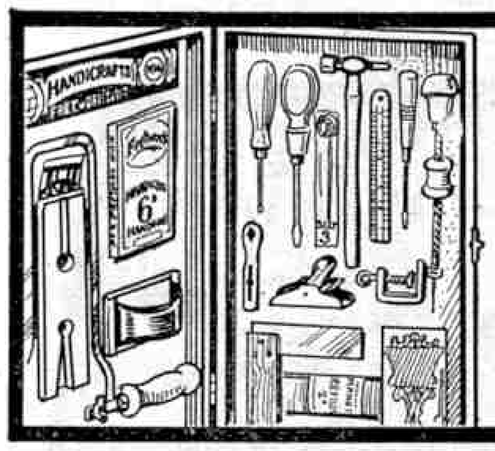

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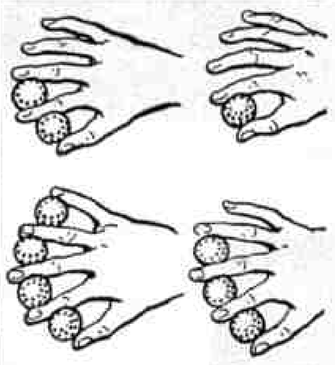

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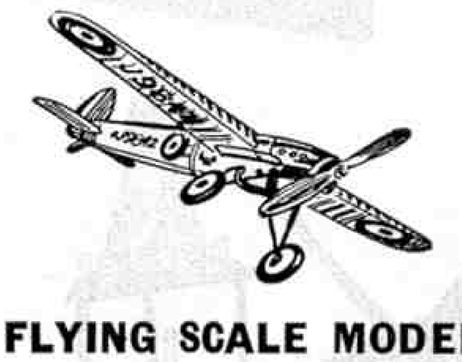

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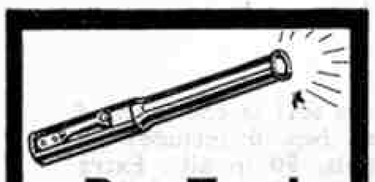

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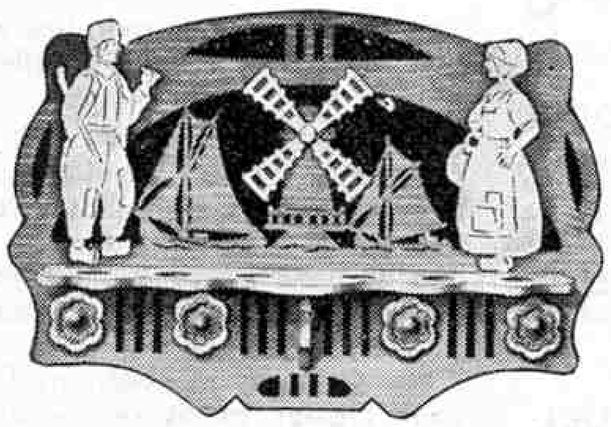

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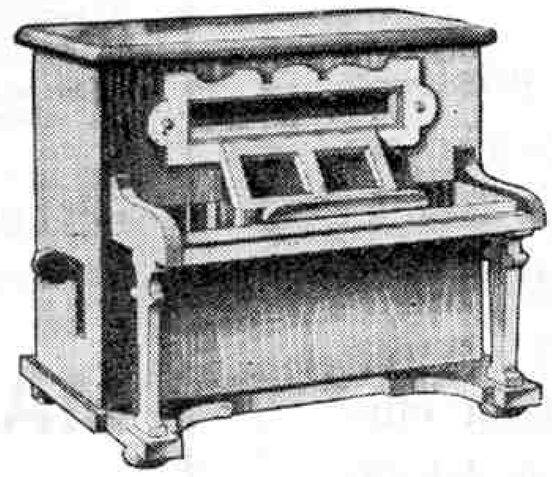

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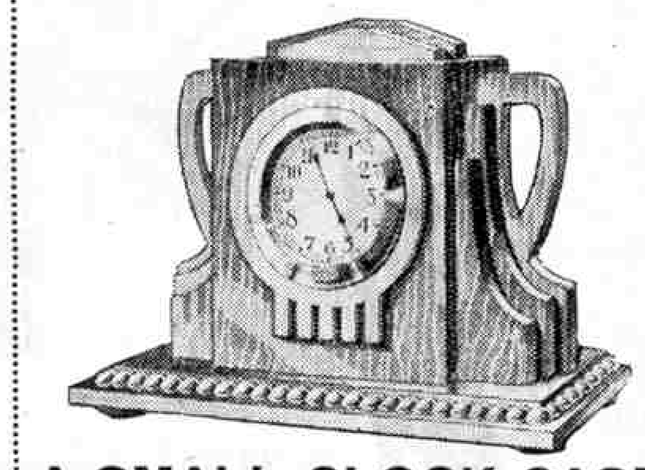

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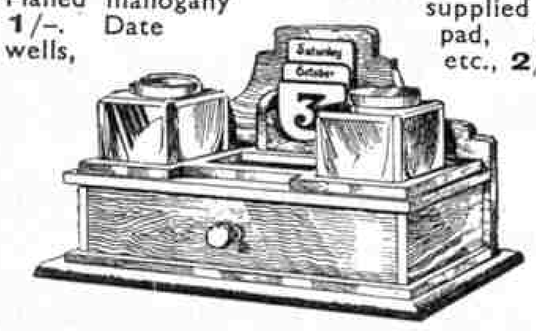

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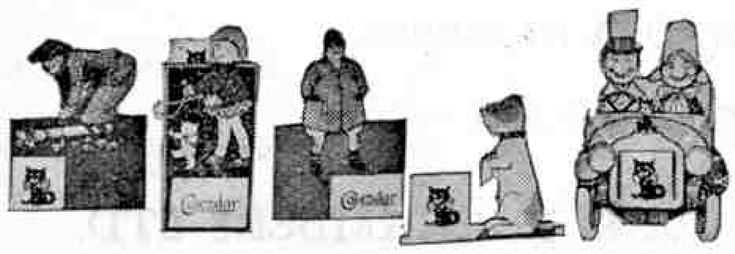

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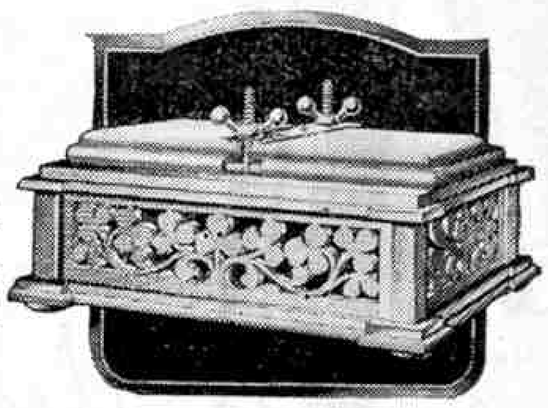

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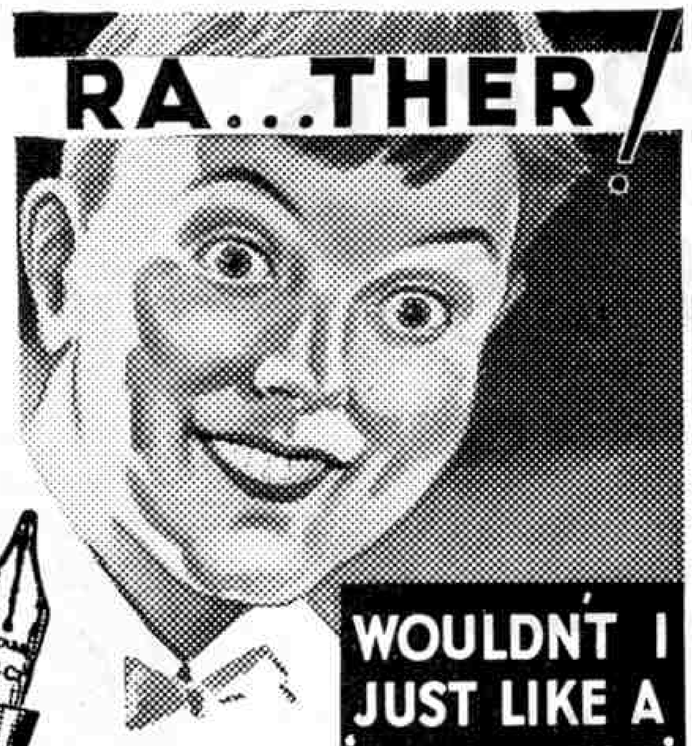

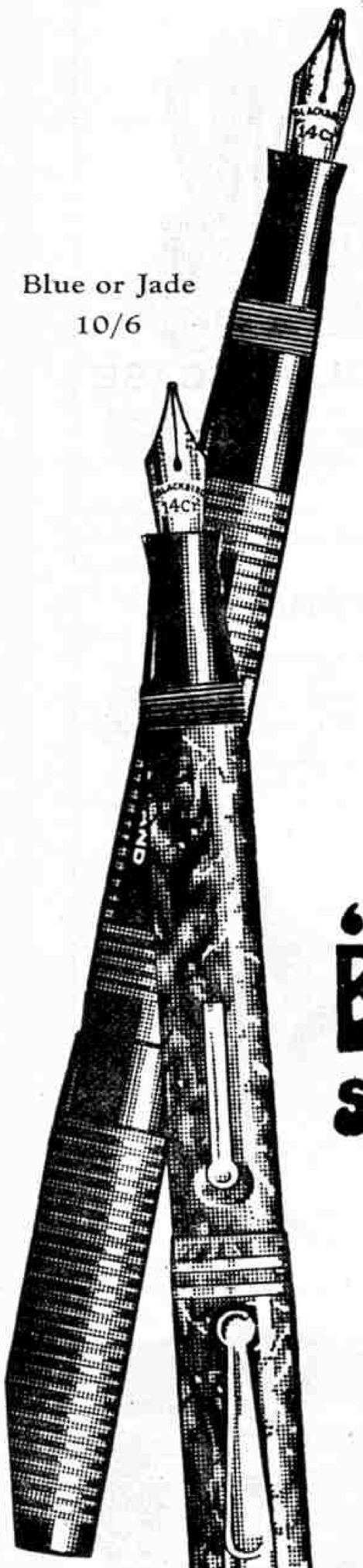

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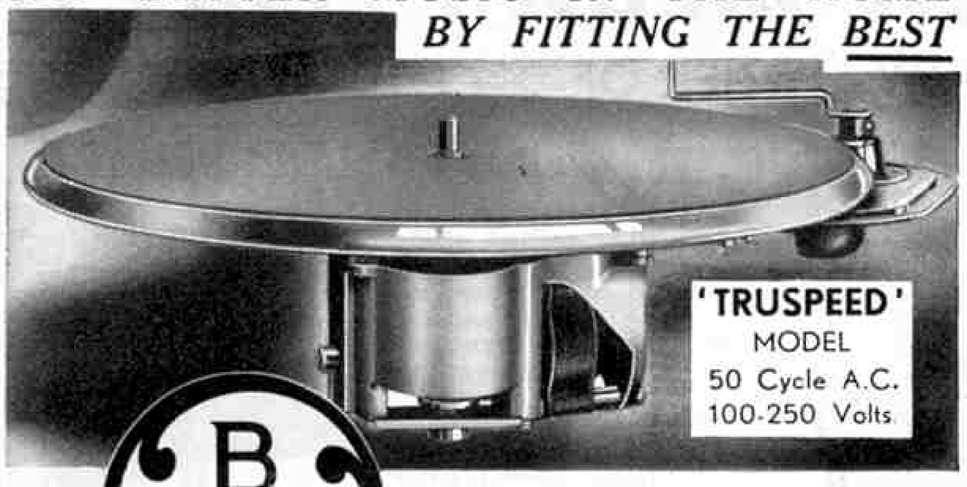

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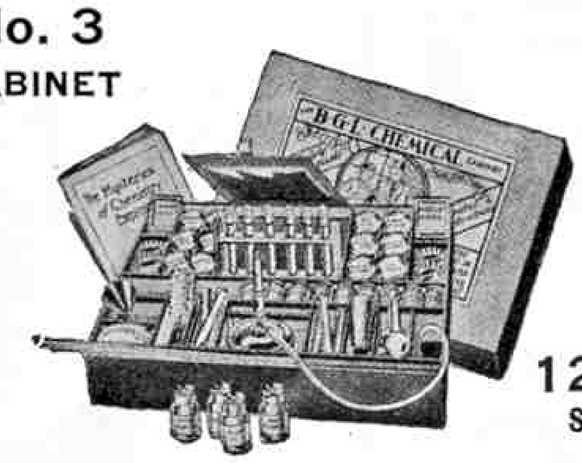

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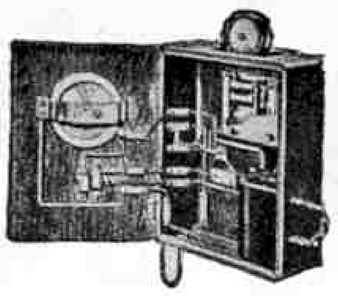

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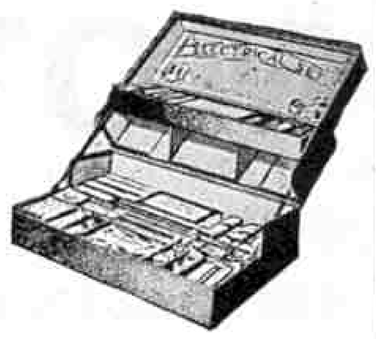

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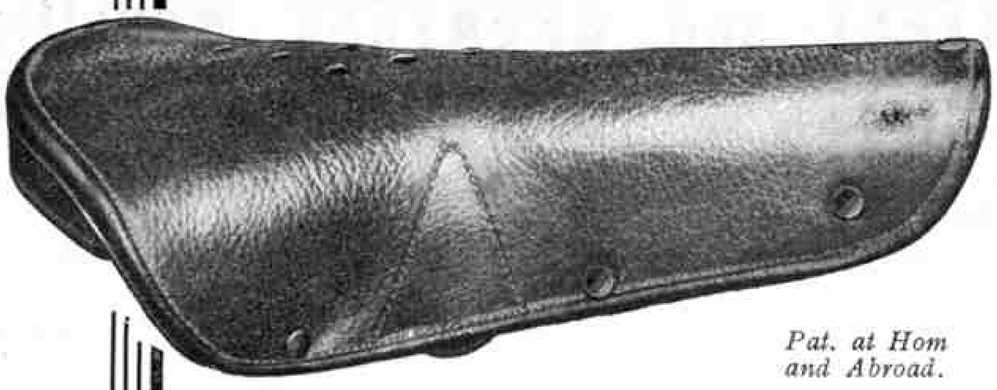

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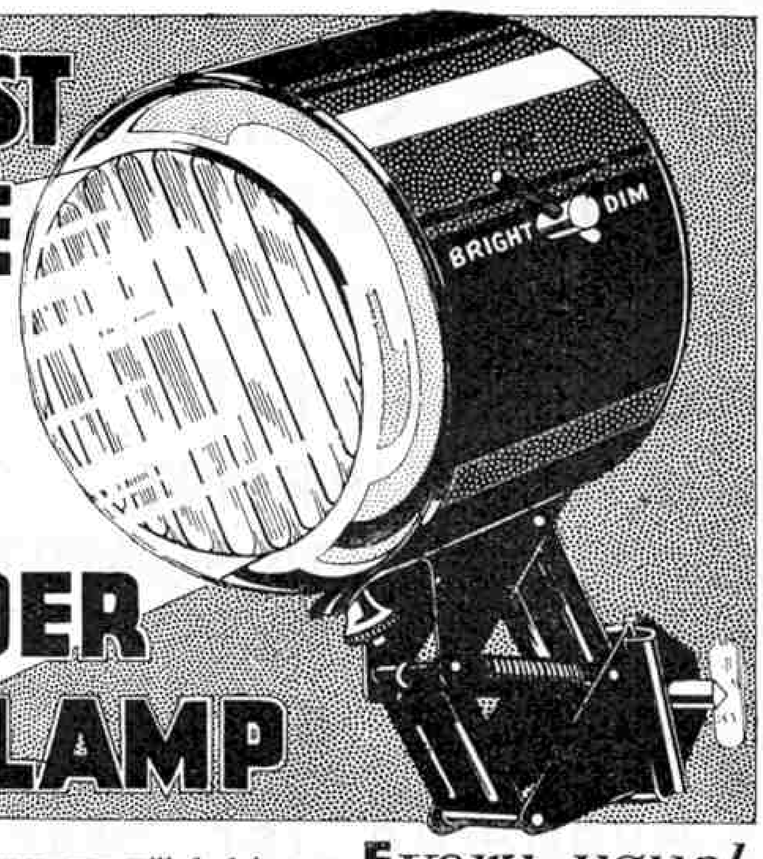

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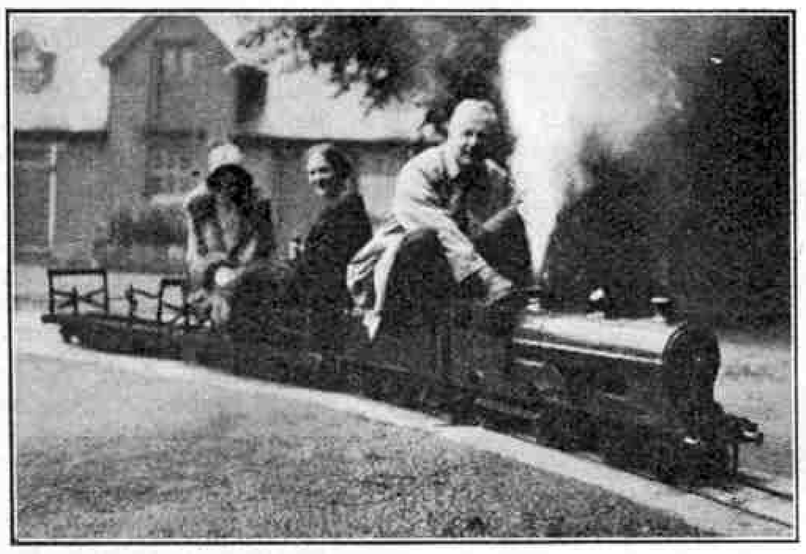

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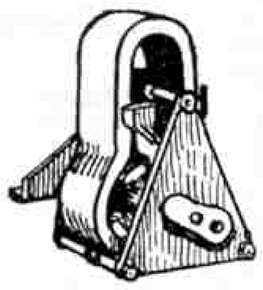

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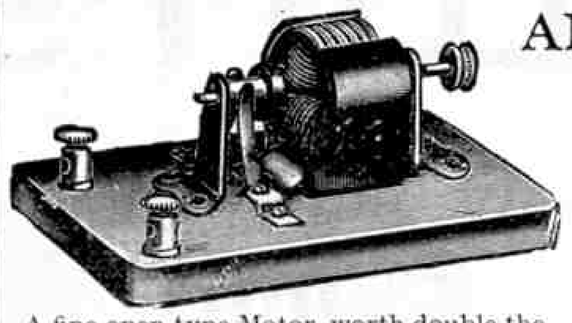

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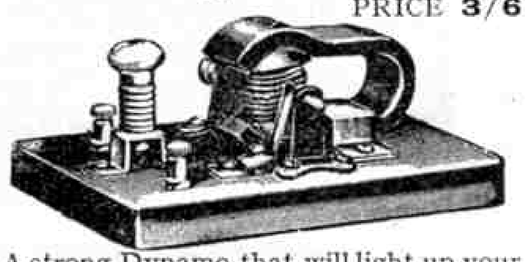

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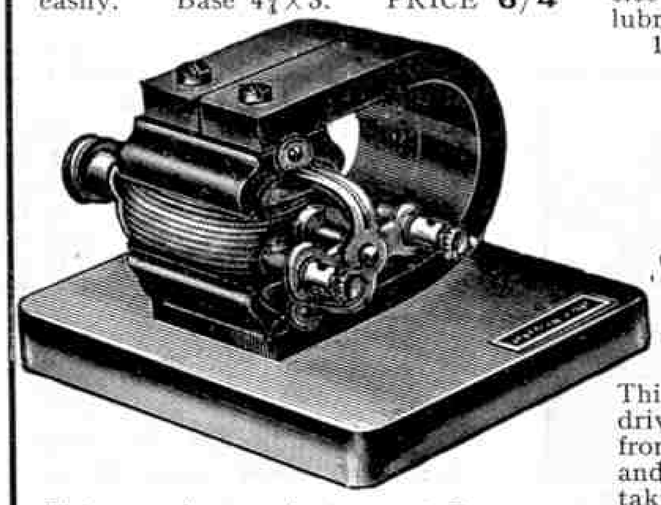

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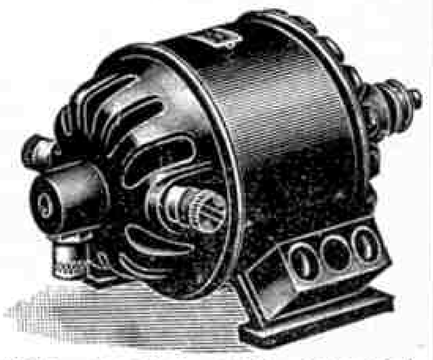

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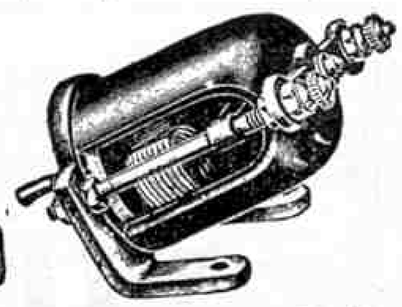

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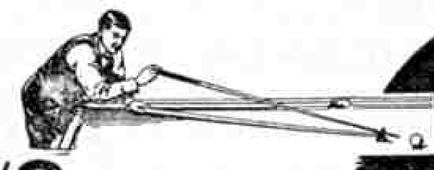

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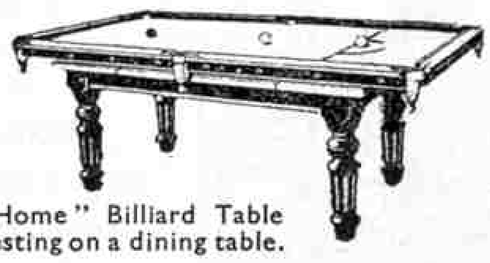

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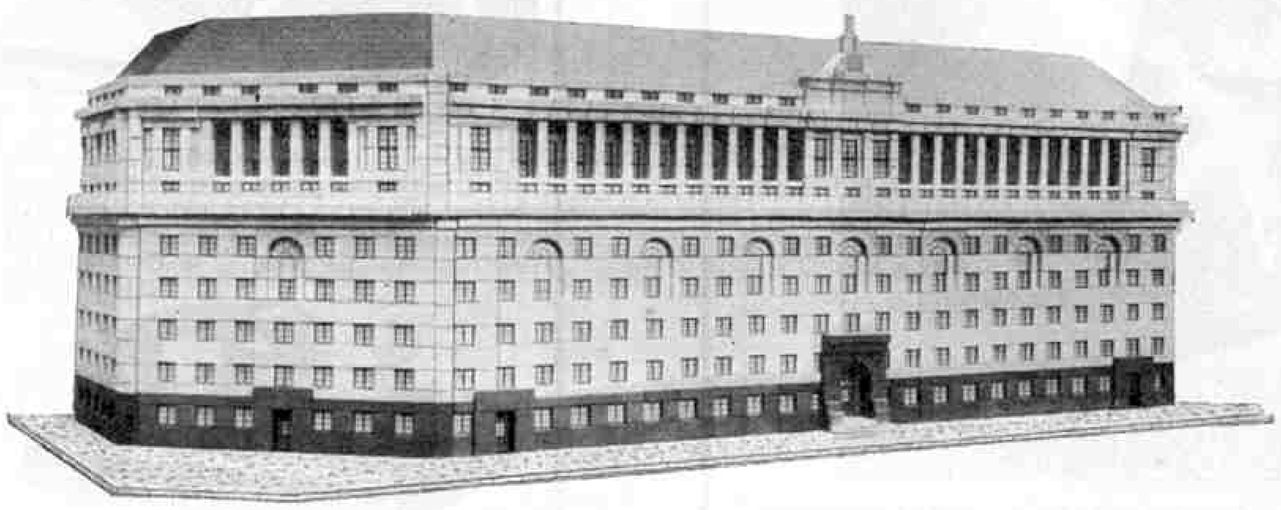

The model illustrated above is built entirely with Lott's Bricks and measures over 5 feet long. Readers may notice the resemblance to one of London's big new buildings.

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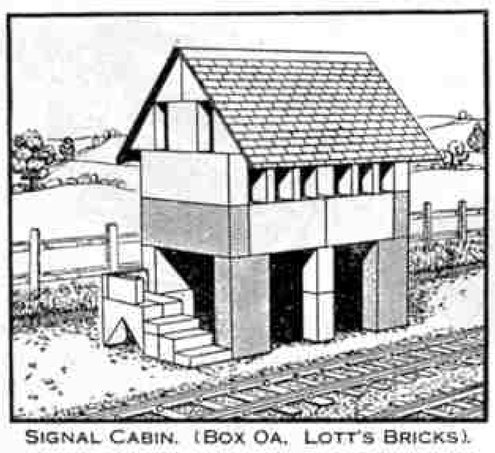


SIGNAL CABIN. (BOX OA. LOTT'S BRICKS).

LIST OF PRICES

LOTT'S BRICKS

Box 0.	6 Models	...	2/–
„ 0A.	12 „	...	3/3
„ 1.	30 „	...	5/–
„ 1A.	12 „	...	5/6
„ 2.	48 „	...	10/–
„ 2A.	18 „	...	10/6
„ 3.	72 „	...	17/6
„ 3A.	6 „	...	7/6
„ 4.	84 „	...	25/–
„ 4A.	6 „	...	7/6
„ 5.	100 „	...	35/–

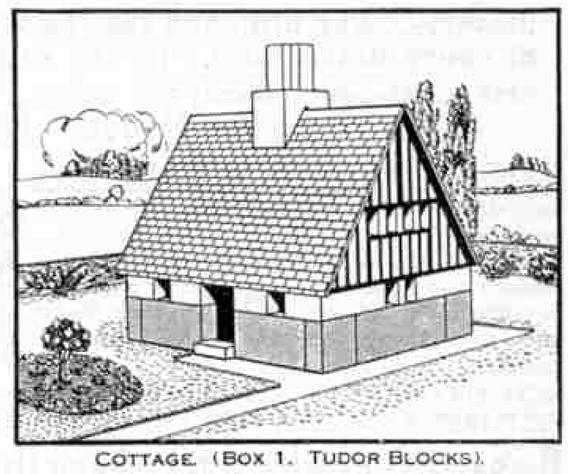
Boxes 1, 1A, 2 and 2A contain trees and white paling fences.

TUDOR BLOCKS

Box 1.	12 Models	...	3/6
„ 2.	18 „	...	7/6
„ 3.	36 „	...	21/–
„ 4.	43 „	...	35/–
„ 1A.	(Supplement)		4/6
„ 2A.	„		10/6
„ 3A.	„		15/–

LODOMO

Box 1.	18 Models	...	3/6
„ 2.	50 „	...	7/6
„ 3.	72 „	...	12/6
„ 1A.	(Supplement)		4/–
„ 2A.	„		5/–
Railway Box	...	...	17/6



COTTAGE. (BOX 1. TUDOR BLOCKS).

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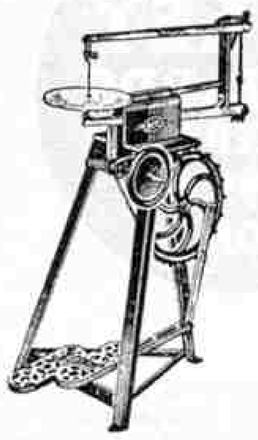

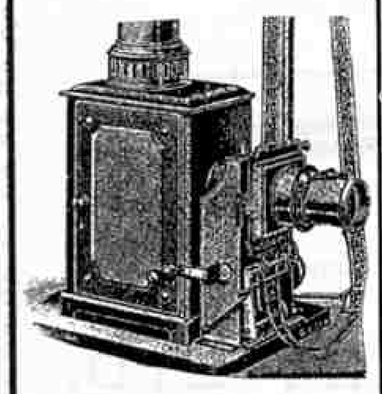

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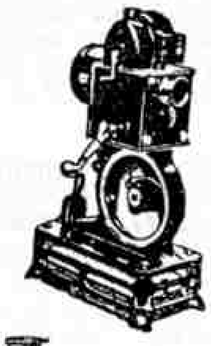

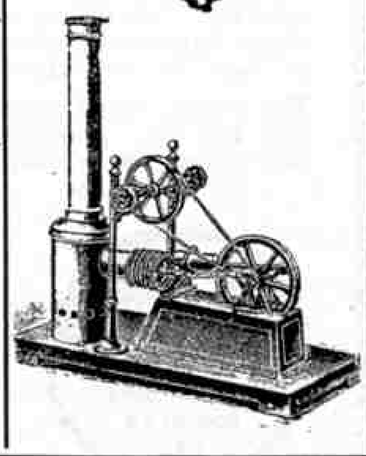

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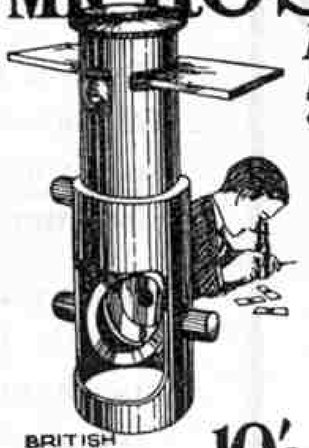

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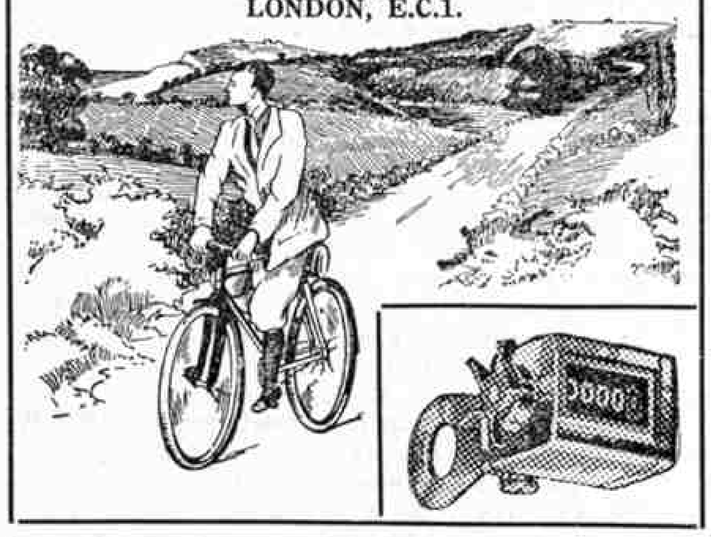

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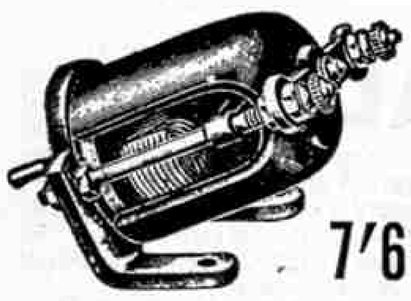

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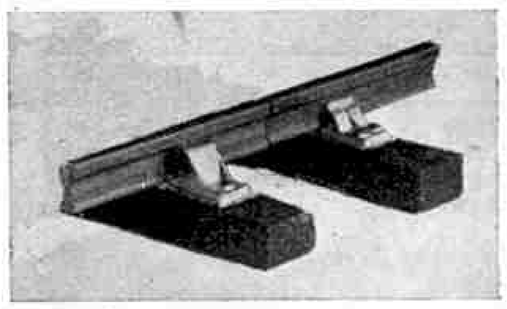

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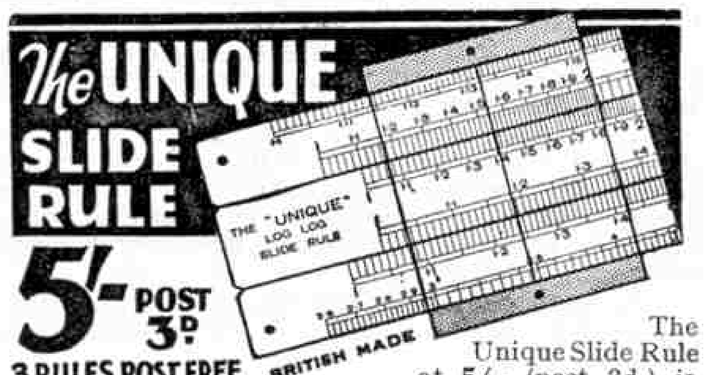

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Stamp Advertisements cont. from p. 892

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Sale. Cassells "Popular Educator," "Life of Haggard," "Story of Africa," "Boys' Owns," "Captains," etc., "Meccano Magazines," 1924-31, "Union Jacks," "Skippers," "Scouts," etc., Cigarette Cards. Stamp for particulars.—Chapman, 286, Renton Place, Walworth, London, S.E.17.

Sale. 30" Yacht, would exchange for Stuart B.B., Sun or G.F. engine.—Smiles, 51, Whitworth Road, Southampton.

Steam Locomotive, Cinematograph, Aeroplane, Boats, Books, Railway Accessories, Cameras, etc. Stamp for list.—4, Lorne Road, Leicester.

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Wanted. Meccano Magazine, March, 1932.—Ellingford, Red Lion Hill, Stanford-le-Hope, Essex.

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MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE :—
OLD SWAN, LIVERPOOL, ENGLAND.
Telegrams : "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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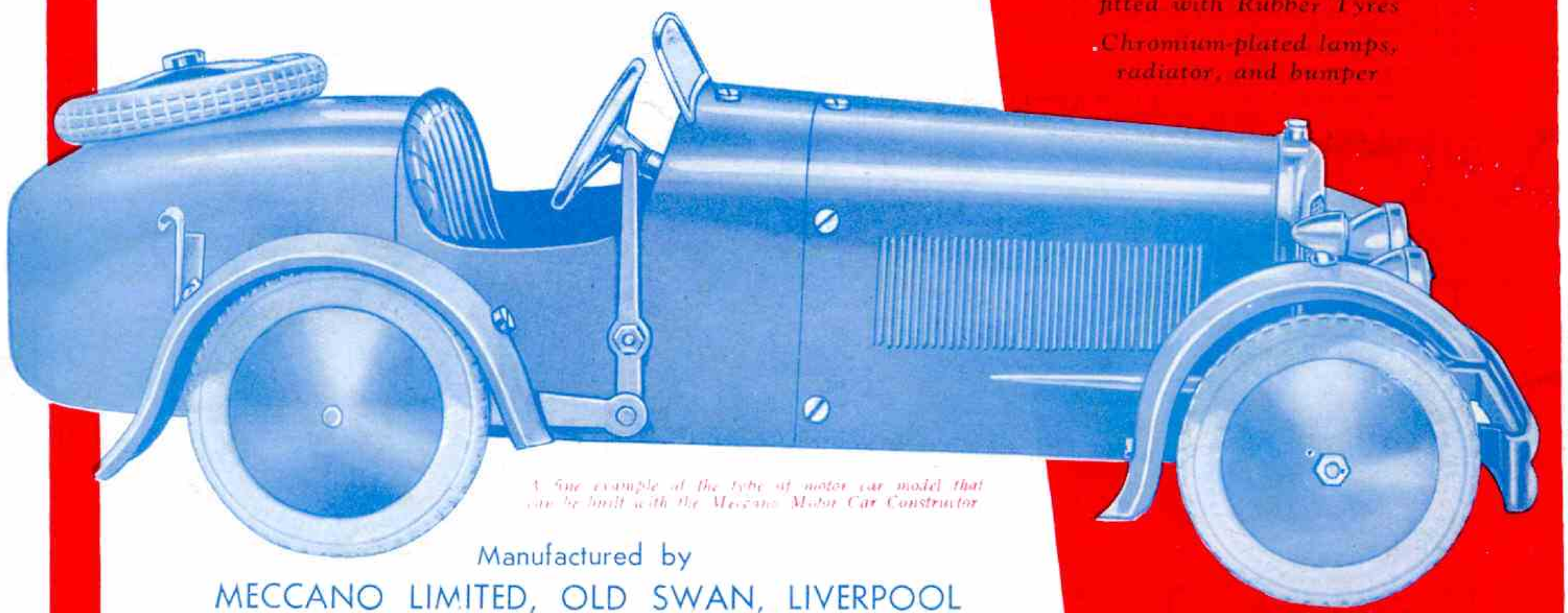

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